



Forest Service  
Region 1  
Northern Region



Montana  
Department of  
Natural Resources  
and Conservation  
Forestry Division



Forest Health  
Protection  
Report 17-02

# Montana Forest Insect and Disease Conditions 2017



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# MONTANA

## Forest Insect and Disease Conditions

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Western Spruce Budworm, USDA Forest Service

Douglas-fir beetle damage and larva, courtesy of Brytten Steed, USDA Forest Service

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## ABBREVIATIONS

The following abbreviations are used throughout this document:

<u>Category</u>	<u>Abbr.</u>	<u>Name</u>
<b>Beetles</b>	DFB	= Douglas-fir beetle
	FE	= Fir engraver
	PE	= Pine engraver
	MPB	= Mountain pine beetle
	RTB	= Red turpentine beetle
	SB	= Spruce beetle
	WBBB	= Western balsam bark beetle
	WPB	= Western pine beetle
	DFTM	= Douglas-fir tussock moth
<b>Defoliators</b>	LCB	= Larch casebearer
	PB	= Pine butterfly
	WSBW	= Western spruce budworm
	SAF Mort	= Subalpine fir mortality
	UNKD	= Unknown defoliator
<b>Exotic Insects</b>	BWA	= Balsam woolly adelgid
<b>Pathogens</b>	LNC	= Larch Needle Cast
	LPPDM	= Lodgepole pine dwarf mistletoe
	LPDM	= Limber pine dwarf mistletoe
	MB	= Marssonina blight
	DFDM	= Douglas-fir dwarf mistletoe
	WLDM	= Western larch dwarf mistletoe
	WPBR	= White pine blister rust
<b>Hosts</b>	DF	= Douglas-fir
	ES	= Engelmann spruce
	GF	= Grand fir
	HE <sub>5</sub> NP	= High elevation five needle pines
	LP	= Limber pine
	LPP	= Lodgepole pine
	PP	= Ponderosa pine
	QA	= Quaking aspen
	SAF	= Subalpine fir
	WBP	= Whitebark pine
	WL	= Western larch
	WWP	= Western white pine
	ADS	= Aerial Detection Survey
	BLM	= Bureau of Land Management
	FIA	= Forest Inventory and Analysis
<b>Other</b>	FHP	= Forest Health Protection
	FS	= Forest Service
	MT	= Montana
	NF	= National Forest
	NP	= National Park
	IR	= Indian Reservation
	RA	= Reporting Area
	RD	= Ranger District
	TPA	= Trees per acre

## HIGHLIGHTS

- Root disease fungi cause damage and mortality on nearly 3 million acres of National Forest lands in western Montana every year.
- White pine blister rust continues to damage and kill all three of the five-needle pine species in the state across their range.
- The acreage for larch needle cast in 2017 quadrupled compared to detected acres in 2016 coming in at over 9,000 affected acres.
- Mountain pine beetle caused mortality continues to decline from 2009 peak levels of 3.7 million acres to 7,922 acres in 2017.
- Western spruce budworm defoliation continues to decline from 1,205,015 affected acres in 2016 to 350,325 affected acres in 2017.

## SUMMARY OF CONDITIONS

### Bark Beetles

#### *Mountain pine beetle*

Mortality of pine species caused by mountain pine beetle (MPB) remained low and near 2016 levels. The 25% decrease in total acres affected in 2017 coincides with the 25% drop in total-area surveyed. The total area surveyed encompassed 25,000 acres with 8,000 acres of noted mortality. The majority of tree mortality (>75%) continues to be in LPP, with PP, HE5NP, and WWP incurring minimal amounts. The majority of area affected (>85%) was on National Forest lands, the rest was distributed across Federal, State and private ownerships. Counties that have had MPB activity in the past continue to have small numbers of trees killed, no areas of significantly increased activity were detected. Only Sanders County had more than 1,000 acres of detected MPB mortality with a total of 2,700 acres. Actual MPB activity in some areas may be lower due to limited field evaluations that can indicate tree mortality attributed to MPB but may be due to secondary bark beetles.

#### *Douglas-fir beetle*

Most of the Douglas-fir host type throughout Montana has experienced severe WSBW defoliation over the past fifteen years. These events, as well as the substantial 2017 wildfire season, is likely to promote increased DFB activity during subsequent years.

DFB-caused mortality acreage may be under-reported across Montana due to difficulties associated with aerial surveying as a result of the widespread smoke conditions and restricted flight paths as a result of the 2017 wildfire season.

#### *Pine Engraver*

Mortality of LPP and PP due to PE remained low and continued to decline in 2017 (400 acres). Part of the decline may be due to a 25% decrease in the area surveyed. However, this cannot fully account for the 80% decrease in PE-caused tree mortality acreage. The majority of PE activity in the State (>97%) was detected in PP. Over half of the tree mortality was surveyed on private lands, though all ownerships have affected acres. Most counties had less than 100 impacted acres; only Lewis and Clark County had over 100 acres of tree mortality.

#### *Spruce Beetle*

State-level area estimates for SB-caused mortality remained constant, causing very low levels of mortality in 2017, similar to 2016 estimates. Beetle populations remained endemic throughout Montana. Damage was limited to isolated pockets scattered throughout Engelmann spruce stands which are primarily located in drainages within National Forest (NF) land ownerships across the state.

### Defoliators

The number of acres defoliated by WSBW decreased but remain high at over 300,000 thousand acres as compared to over 900,000 acres in 2016. The decrease in acreage may be a result of the inability to survey because of the widespread wildfire activity in Montana in 2016 and 2017. It is anticipated that this trend will



continue in 2018 as the areas surveyed will decrease in conjunction with the increase in burned acreage. Defoliation in 2017 occurred in counties both east and west of the Continental Divide.

Areas with significant levels of WSBW-caused defoliation (>30,000 acres) were in Beaverhead, Gallatin, Lewis and Clark, Madison, Park and Ravalli counties. In 2017, defoliation intensity remained high in many areas, especially on several forests east of the Continental Divide, where WSBW has been recorded for several years. WSBW occurred in most counties with susceptible host type (Douglas-fir, subalpine fir and Engelmann spruce) on forested lands including NF lands intermingled with surrounding lands of other ownerships.

Defoliation from DFTM, PB or LCB was not detected in 2017. Trap catches in Idaho for DFTM continue to increase which suggests that visible defoliation from DFTM may occur within the next few years especially in Idaho and possibly in susceptible Douglas-fir forests in Montana.

New for the 2017 detection season; about 1,200 acres of WL were defoliated by larch sawfly in Mineral and Sanders counties. Nearly 1,000 acres were recorded as impacted by an unidentified defoliator which appears to be Aspen dieback/decline. Aspen dieback will be the new coding scheme from the Forest Health Assessment & Applied Science Team (FHAASST) for this type of damage. Affected acres were scattered throughout the Helena-Lewis & Clark and Gallatin NFs and Rocky Boy's IR.

Damage from BWA occurred on approximately 1000 acres in Montana, primarily in Mineral County.

## **Root Disease/Beetle Complex**

Root Disease / Beetle Complex is the new group designation used to integrate SAF Mortality-complex into the new DMSM methodology. Root Disease / Beetle Complex is SAF mortality found by ADS at varying levels on an annual basis. We believe that most SAF mortality involves western balsam bark beetle but there are other agents, including root diseases. Because we cannot ground truth all of the SAF mortality we record with ADS to identify the mortality agent, we created the grouping of Root Disease / Beetle Complex to cover multiple mortality causing agents. In 2017, Root Disease / Beetle Complex was found in approximately 6,300 acres of SAF in high elevation forests throughout the state.

## **Root Diseases**

The most impactful root diseases are Armillaria root disease, laminated root rot, Heterobasidion root disease, schweinitzii root and butt rot; and to a lesser extent, tomentosus root rot. Root disease fungi are native soil borne organisms that persist for many years in both living trees and residual stumps, root diseases are considered components of a local ecosystem that are not readily removed. The gradual expansion of root disease centers primarily through underground infestation of adjacent root systems dictates that acres affected by root disease do not change drastically from one year to the next.

Based on a recent assessment using FIA plots, root disease fungi are estimated to cause damage and mortality on nearly 3 million acres of NF lands in western Montana. Root disease hazard, calculated from the FIA root disease data, occurs at various levels on over 6.5 million acres on all ownerships in western Montana. Root disease-caused mortality is more common west of the Continental Divide where susceptible hosts and suitable

fungal habitat coincide. We currently do not have an assessment of root disease distribution and impact east of the Continental Divide. In general, large areas of root disease can be found east of the Divide, but it tends to occur in more discrete patches, rather than being ubiquitous throughout an area. Root diseases can be commonly found in riparian areas east of the Continental Divide, often in ES and SAF.

## **Dieback**

Dieback of QA was observed mostly east of the Continental Divide, but also detected in Powell County. Over 1,000 acres were widely scattered east of the Divide, with greatest concentrations along the Rocky Mountain Front in Teton County and in the Big Snowy and Highwood Mountains.

## **Foliar Diseases**

Foliar diseases were at relatively low levels in 2017. The only foliar disease recorded during aerial surveys consisted of 9,076 acres of LNC, which increased substantially from 2,100 acres detected in 2016. These acres were scattered across the counties of northwestern and west central Montana with more than half the acres detected in Flathead County. The cool wet conditions that prevailed in NW Montana during spring 2017 facilitate spread of the rain-dispersed LNC fungal spores and maintained prolonged periods of leaf wetness necessary for infection.

## **Dwarf Mistletoes**

Historical assessments of dwarf mistletoe stands in Montana show that about 16% of DF, 33% of LPP, and 30% of WL stands are infected. More recent assessments using FIA data collected on 50,000 trees across Montana show only about 1% of DF, 3.2% of LPP, and 3.9% of WL that are infected. The clumpy distribution and protracted disease-cycle of dwarf mistletoes allow for impacts across an individual stand to range from low to severe. This variability is also the reason for differences between these two measurements; the first is measuring infected stands and the second is measuring infected trees.

## **White Pine Blister Rust**

Western white pine, WBP, and LP are all susceptible to white pine blister rust.

### *Western white pine*

Acres of mature WWP continue to decline due to a combination of WPBR, MPB, and loss of suitable growing sites. WPBR and MPB cause mortality of sexually mature branches and trees, reducing the seed available for production of subsequent generations. Moreover, WPBR can also kill young seedlings virtually eliminating natural regeneration in heavily infested stands. Because the shade-intolerant WWP requires large canopy openings to regenerate in ample numbers, limitations on even-aged silvicultural techniques (clearcuts) and the suppression of natural wildfire restrict the ability of WWP to compete with shade-tolerant GF, WRC, or WH. Rust-resistant stock is planted operationally on sites that have been prepared to support WWP in federal, state, and private forest lands throughout northwestern Montana. In addition to planting rust-resistant stock, pruning of the lower bole is an important tool used in WPBR management to reduce the volume of host material at heights of greatest aerial fungal spore density and to remove potentially lethal branch infections before they reach the stem.

### *Whitebark pine & limber pine*

WPBR on grassland and high elevation 5-needle pines is of great concern because of the limitation of these species to specialized habitats with often severe environmental conditions that routinely challenge regenerative success. LP is found in scattered populations in eastern and central Montana at elevations ranging from 2,700 to 9,000 feet. The range of whitebark pine extends further west in the state but in a more restricted altitudinal zone from 6,000 to 9,500 feet. In addition to the impacts of WPBR on survival and reproduction of whitebark and limber pines, outbreaks of MPB compound losses of mature trees. The combination of WPBR, MPB, and competition with shade-tolerant conifers that encroach on canopy openings and occupy seedling sites compromises the long-term stability of WBP and LP ecosystems. There are few areas where LP remains apparently free of disease, including locations southwest of Ennis and south of Billings.

## ANNUAL AERIAL DETECTION SURVEY

Aerial detection surveys are an overview assessment designed to locate and document forest change events, as seen from the air. It is a form of observational data collection that allows trained specialists to survey large tracts of forested land in a relatively short period of time. Single engine, high-wing aircraft flying at speeds of approximately 90 to 130 mph at an average altitude of 1,500 feet above ground level are used to fly either grid or contour patterns within a Reporting Area. The damage extent and intensity of the aerially detected signatures of recently killed or defoliated trees are delineated as polygons using specialized software. Areas burned by wildfire are not surveyed until the third year following a fire. The actual amount of mortality from tree diseases, dwarf mistletoes, and WPBR are greatly underestimated with ADS because symptoms from these agents can be difficult and, in some instances, impossible to identify from the air.

The Digital Mobile Sketch Mapping (DMSM) project from FHAAS (Forest Health Assessment and Applied Sciences Team) characterizes damage intensity by the percent of live and standing dead trees within the cell or polygon that are damaged/recently dead. For small groups of damaged trees captured as point features, DMSM uses tree count classes.

Referred more simply as 'percent-class', DMSM requires a percent-of-tree-canopy-affected call on all damage areas (cells and polygons) regardless of damage type. Similarly, a tree count range of affected trees is required for all damage features represented as points.

The list of Damage Intensity classes for areas and points is shown below:

<b>PCT_AFFECTED*</b>	<b>Number of Trees**</b>
Very Light (1-3%)	1
Light (4-10%)	2 - 5
Moderate (11-29%)	6 - 15
Severe (30-50%)	16 - 30
Very Severe (>50%)	> 30

\* Percent Affected used for damage polygons & grid cells

\*\* Number of Trees used for damage point features

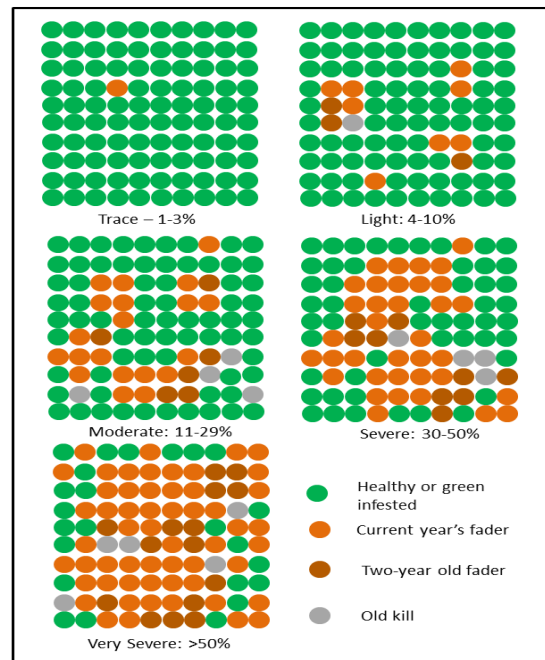
The percent-class method equates a single large crown tree with a similar canopy area comprised of tightly spaced smaller crown trees.

This percent or ratio can be expressed as:

Number (area of canopy) of damaged or recently dead trees within the damage area polygon or grid cell
Number (area of canopy) of all live and standing dead trees within the damage area polygon or grid cell

Note that the treed area (the denominator in the percent of trees call) is all trees, not just hosts, nor just live trees but standing dead as well. In the graphic below, 'Old kill' and 'Two-year old fader' represent standing dead trees considered part of the treed area denominator:

Also note that non-treed areas (water, roads, meadows, etc.) that may cover part of the damage area polygon or grid cell do not factor into the percent-class call. It is the live and standing dead trees within the polygon or grid cell, and not the area of the polygon or grid cell as a whole that represent the denominator in this equation."



From: U.S. Department of Agriculture, Forest Service, Forest Health Assessment and Applied Sciences Team. 2016. Digital Mobile Sketch Mapping (DMSM) Updates to Forest Health Survey with DMSM. 10p.

The annual ADS in Montana was conducted from July 10 to September 28, 2017. The survey encompassed approximately 25 million acres of mixed ownership forested lands, while excluding most designated wilderness areas (Figure 1). Five FHP observers and 3 trainees, using a mix of contract and Federal aircraft, identified approximately 450,000 acres of forest damage within Montana. Fires from 2016 and 2017 drastically impacted the overall acres surveyed.

For Regional summary purposes, polygon damage intensity or percent affected classes were grouped into severity classes of Low, Medium and High. This grouping occurred for two primary reasons. First, these severity classes represent known damage levels pertinent to forest managers. As an example, low severity mortality rates (<10%) are typically considered as background levels that would not conflict with management objectives whereas Moderate and High Severity rates are often undesirable. Second, as ADS data does not have levels of ground validation sufficient to support standard error attribution to surveyed estimates, collapsing to broad severity classes increases the reliability of this information.

Specifically, classes were grouped as follows. Very Light (1-3%) and Light (4-10%) percent affected became **Low Severity**; Moderate (11-29%) percent affected became **Moderate Severity**; while Severe (30-50%) and Very Severe (>50%) percent affected became **High Severity**. Points were buffered to 2 acres and grouped into **low** and **moderate severity** classes. Point damage ranges of 1, 2-5, 6-15, and 16-30 trees became **Low Severity**; and >30 trees points became **Moderate Severity**.

The data summarized in this report are a product of the annual ADS, as well as ground surveys and biological evaluations. The digital data files, data summaries, and ADS damage maps are available from the Missoula FHP Field Office, in both paper and digital GIS format. Data may also be downloaded from our FS webpage.

<https://www.fs.usda.gov/detail/r1/forest-grasslandhealth/?cid=stelprdb5366459>

## INSECT AND DISEASE CONDITIONS BY COUNTY

### County Results

For each county, damage by ownership is noted and, to the extent possible, we have indicated areas affected and estimated extent of damage. Counties that are not included had no reported information. Forestland data in the following tables are from the annualized surveys performed by USDA Forest Service Forest and Inventory Analysis (<http://www.fia.fs.fed.us>). In some of our tables, you will observe acres of damage on some ownership where there is no forestland reported. Because of the limited forestland within ownerships of some counties, the density of FIA plots may not have been sufficient at the county level to identify forested acres (i.e. forestland exists but was missed in the FIA sample resulting in an estimate of zero acres). This discrepancy is within their standard of error. Other Federal lands include tribal ownership.

### Beaverhead County

**Forestland, Mortality, and Defoliation Acres by Ownership**

	<i>National Forest</i>	<i>Other Federal</i>	<i>Private</i>	<i>State</i>	<i>Total</i>
<b>Forestland</b>	1,087,089	121,922	40,145	29,442	1,278,598
<b>DFB</b>	44	17	4	2	67
<b>MPB</b>	507	16	2	0	525
<b>Root Disease/Beetle Complex</b>	311	101	8	7	427
<b>WPBR</b>	4	0	2	0	6
<b>WSBW</b>	21,540	6,242	2,618	1,485	31,885

Over two million acres were surveyed in 2017, covering much of the same area flown in 2016. Insect activity decreased for all species. MPB affected acres continue to decline; 2016 survey detected 2, 974 whereas this year only 67 acres were reported. Defoliation from WSBW saw a 20,000 acres decrease between the 2016 and 2017 survey seasons. This decrease may be due, in part, to the impacts of 2017 wildfires and smoke conditions that limited visibility and the ability to detect defoliation during surveys.

Nine acres of QA dieback were observed approximately 1 mile east of the trailhead on FS Road 1079. WPBR is common in WBP and LP. LPDM is present in this county.

### Big Horn County

Aerial surveys did not cover this county in 2017 and no information was submitted documenting conditions from ground surveys.

## Blaine County

### Forestland, Mortality, and Defoliation Acres by Ownership

	<i>National Forest</i>	<i>Other Federal</i>	<i>Private</i>	<i>State</i>	<i>Total</i>
<b>Forestland</b>	0	71,085	59,888	5,079	136,051
<b>BWA</b>	40	0	0	0	40
<b>DFB</b>	2,134	188	23	4	2,556
<b>DFTM</b>	0	29	4	16	49
<b>FE</b>	48	0	0	0	48
<b>MPB</b>	6	55	0	0	61
<b>Root Disease and Beetle Complex</b>	36	0	3	0	39
<b>SB</b>	2	0	0	0	2
<b>WBBB</b>	20	0	0	0	20
<b>WPB</b>	6	2	0	0	8
<b>WSBW</b>	440	0	0	0	440

There was a twenty percent increase in the surveyed area in 2017, but insect activity remained at low levels. DFB activity was negligible and detected MPB activity was about 60 acres. Defoliation continues to remain low in this county though a small area, 49 acres of DFTM was detected.

## Broadwater County

### Forestland, Mortality, and Defoliation Acres by Ownership

	<i>National Forest</i>	<i>Other Federal</i>	<i>Private</i>	<i>State</i>	<i>Total</i>
<b>Forestland</b>	151,813	27,911	98,548	0	278,272
<b>DFB</b>	118	0	2	0	120
<b>MPB-LPP</b>	0	0	574	0	574
<b>MPB-PP</b>	6	2	199	6	213
<b>MPB-High Elevation</b>	6	0	0	0	6
<b>PE</b>	5	0	0	0	5
<b>Root Disease/Beetle Complex</b>	2	0	0	0	2
<b>WSBW</b>	320	0	1,601	153	2,074

The aerial survey covered much of the same areas in 2016 and 2017 with little change in insect activity. Bark beetle and defoliator damage remains low with less than 150 acres of DFB-caused mortality and 2,000 acres of WSBW-caused defoliation. The decrease in WSBW defoliation may be due, in part, to the impacts of the 2017 smoke conditions associated with wildfires that occurred throughout the state limiting visibility and the ability to detect subtle signatures of defoliation during surveys.

## Carbon County

Aerial surveys did not cover this county in 2017 and no information was submitted documenting conditions from ground surveys.



## Cascade County

### Forestland, Mortality, and Defoliation Acres by Ownership

	<i>National Forest</i>	<i>Other Federal</i>	<i>Private</i>	<i>State</i>	<i>Total</i>
<b>Forestland</b>	191,929	14,555	91,076	15,428	312,988
<b>DFB</b>	762	10	52	6	830
<b>MPB</b>	238	7	44	4	986
<b>Root Disease/Beetle Complex</b>	20	0	4	0	24
<b>SB</b>	2	0	0	0	2
<b>WPBR</b>	100	0	0	0	100
<b>WSBW</b>	47	454	278	71	779
<b>PE</b>	0	0	8	0	8

Only the southern portion of Cascade County was surveyed in 2017 yet a greater area was flown relative to the 2016 survey. Total area mapped with DFB increased in 2017 primarily in the southeastern portion of the county. Mapped WSBW activity decreased substantially. MPB activity was low within PP and LPP hosts throughout the surveyed area.

About 5 acres of QA dieback were observed in two polygons. One 3-acre polygon was about 10 miles ENE of Belt and one 2-acre polygon was about 8 miles northeast of Millegan. Armillaria root disease is present in the southeastern portion of the county, and schweinitzii root and butt rot is quite common, causing significant decay in butt logs of large, > 100 year old DF. Tomentosus root rot is known to occur in several areas within the county. WPBR is common in LP in this county.

## Chouteau County

### Forestland, Mortality, and Defoliation Acres by Ownership

	<i>National Forest</i>	<i>Other Federal</i>	<i>Private</i>	<i>State</i>	<i>Total</i>
<b>Forestland</b>	14,934	6,597	38,185	1,504	61,221
<b>DFB</b>	30	40	70	0	140
<b>MPB</b>	20	4	28	0	52
<b>WPBR</b>	2	40	0	0	42
<b>WSBW</b>	418	0	211	0	699
<b>PE</b>	0	2	2	2	6

The 2017 aerial detection survey covered the same areas flown in 2016. An increase in both DFB and WSBW activity was noted in 2017 although total acres of any damage remained low.

About 181 acres of QA dieback were observed in this county. This damage was detected in about 20 polygons with about half of them in the Highwood Mountains and about half spread through the remainder of the county. Armillaria root disease is present in the Highwood Mountains.

## Deer Lodge County

### Forestland, Mortality, and Defoliation Acres by Ownership

	<i>National Forest</i>	<i>Other Federal</i>	<i>Private</i>	<i>State</i>	<i>Total</i>
<b>Forestland</b>	200,661	7,079	43,542	33,513	284,795
<b>DFB</b>	2	0	6	0	8
<b>MPB</b>	512	8	6	0	526
<b>Root Disease/Beetle Complex</b>	4	0	0	0	4
<b>WPBR</b>	0	4	0	0	4
<b>WSBW</b>	404	2976	552	0	3932

Despite a slight decrease in total area flown, insect activity in 2017 largely remained the same or decreased. The one exception was MPB in LPP that showed an increase in activity to approximately 500 acres. Field assessments of scattered LPP mortality on the Beaverhead-Deerlodge NF found that trees were killed by secondary bark beetles, not MPB as previously ascribed. Decreases in WSBW defoliation to less than one third of 2016 levels may reflect limitations in the ability to visually detect subtle signatures of defoliation due to wildfire smoke during surveys.

## Fergus County

### Forestland, Mortality, and Defoliation Acres by Ownership

	<i>National Forest</i>	<i>Other Federal</i>	<i>Private</i>	<i>State</i>	<i>Total</i>
<b>Forestland</b>	81,324	170,469	265,345	13,058	530,197
<b>DFB</b>	40	12	24	2	78
<b>MPB</b>	26	33	93	10	161
<b>Root Disease/Beetle Complex</b>	24	4	2	0	30
<b>WSBW</b>	852	12	4	7	875
<b>PE</b>	24	6	38	2	70
<b>Snow-Ice</b>	0	3	3	0	6
<b>ESB</b>	0	2	0	0	2

Despite a 25% decrease in area surveyed in 2016, levels of insect activity detected in 2017 continue to drop. Less than 200 acres of MPB activity were detected and under 900 acres of WSBW defoliation were noted. The decrease in WSBW defoliation may be due, in part, to the impacts of 2017 wildfires and smoke conditions that occurred throughout the state limiting visibility and ability to detect subtle signatures of defoliation during surveys.

Several areas totaling 317 acres of QA dieback were observed in the Big Snowy, Little Snowy, and other areas of the county. Most of those acres were in two large polygons on the north side of the Big Snowy Mountains. About 30 acres were in the Little Snowy Mountains on the south side of Willow Creek and about 7 acres were observed about 0.6 miles northwest of Lookout Peak. Two polygons, 3 acres each, of snow/ice damage in QA were also observed. One was about 0.75 miles NNW of New Year Peak and the other was at the head of Whiskey Gulch.

Armillaria root disease occurs in the Moccasin Mountains north of Lewistown and near Crystal Lake south of Lewistown. LPPDM is present in the county.

## Flathead County

### Forestland, Mortality, and Defoliation Acres by Ownership

	<i>National Forest</i>	<i>Other Federal</i>	<i>Private</i>	<i>State</i>	<i>Total</i>
<b>Forestland</b>	1,730,421	489,558	419,980	131,393	2,771,351
<b>BWA</b>	2	0	0	0	2
<b>DFB</b>	1,779	176	201	70	2,226
<b>Drought</b>	138	0	330	59	527
<b>ESB</b>	2	0	0	0	2
<b>FE</b>	91	0	40	90	221
<b>Larch Needle Diseases</b>	4,028	617	133	1,168	5,946
<b>MPB</b>	668	84	19	2	773
<b>Root Disease/Beetle Complex</b>	588	28	42	39	697
<b>WPBR</b>	19	0	0	0	19
<b>WSBW</b>	3,355	128	103	0	3,586

Less area was flown in Flathead County in 2017 compared to 2016 aerial surveys. Acres mapped with WSBW-caused defoliation were reduced substantially in 2017. However, this may be due in part to the impacts of 2017 wildfires and smoke conditions that occurred throughout the state limiting visibility and ability to detect defoliation during surveys. DFB activity was detected at similar levels to 2016 observations.

Larch needle cast was observed on 5,329 acres, which is a substantial increase from the 84 acres detected in 2016. LNC distribution was county-wide although the greatest concentration occurred in the western part of the county. One small polygon (<2 acres) of flooding near Kishenehn Creek was located about 2 miles northwest of Starvation Ridge in Glacier National Park. Approximately 545 acres of off-color WRC were observed near Whitefish were recognized as potential drought damage. Of the 545-acre estimated area, 180 acres occurred north of Tally Lake, 150 acres were two miles east of Whitefish and 215 acres were one-half mile west of Spoon Lake. Ground observations by aerial detection specialists showed sparse crowns with red cones. In addition to this damage may be a result of late season freeze damage in 2014 (MFO-TR-15-12).

WPBR occurs in both WWP and WBP in Flathead County. Root diseases are common in counties west of the Continental Divide, typically affecting DF and true firs. The more common ones known to occur in Flathead County are fir-type Heterobasidion root disease, Armillaria root disease, and schweinitzii root and butt rot. Heterobasidion root disease is known to occur in PP in this county. DFDM, LPPDM, and WLDM are present and common in the county.

## Gallatin County

### Forestland, Mortality, and Defoliation Acres by Ownership

	<i>National Forest</i>	<i>Other Federal</i>	<i>Private</i>	<i>State</i>	<i>Total</i>
<b>Forestland</b>	582,653	60,036	218,178	16,609	877,475
<b>BWA</b>	218	0	0	0	218
<b>DFB</b>	38	0	49	2	89
<b>ESB</b>	4	0	0	0	4
<b>MPB</b>	156	2	27	44	229
<b>Root Disease/Beetle Complex</b>	577	11	9	0	597
<b>WPBR</b>	92	0	0	0	92
<b>WSBW</b>	16,614	308	11,950	1,224	30,096

In 2017 a greater area was surveyed in Gallatin County as compared to 2016 aerial surveys. Similar rates of WSBW-caused defoliation were detected in 2017 as the acres mapped in 2016. MPBs were active at very low levels within PP, LPP, and WBP hosts throughout the surveyed area.

Ninety-three acres of QA dieback were detected in 8 polygons in the northeast portion of the county. LPPDM is present and a management concern in various areas, especially on flat land with obsidian sandy soils. WPBR is common in WBP and LP in this county. Significant levels of schweinitzii root and butt rot and decay caused by tomentosus root rot in DF and ES occur in campgrounds and other portions of the Custer-Gallatin NF.

## Glacier County

Aerial surveys did not cover this county in 2017 and no information was submitted documenting conditions from ground surveys.

WPBR is common in WBP and LP. Armillaria root disease is known to be a significant pathogen in DF in the western portion of the county on the Blackfeet IR and the Helena-Lewis & Clark National Forest, and LPPDM and WLDM are also present in this county.

## Golden Valley County

### Forestland, Mortality, and Defoliation Acres by Ownership

	<i><b>National Forest</b></i>	<i><b>Other Federal</b></i>	<i><b>Private</b></i>	<i><b>State</b></i>	<i><b>Total</b></i>
<b>Forestland</b>	18,822	6,274	53,398	0	78,494
<b>MPB</b>	6	4	10	0	20
<b>PE</b>	8	8	20	0	36
<b>Root Disease/Beetle Complex</b>	2	0	0	0	2
<b>WSBW</b>	2,280	0	1,058	622	3,960

Slightly more area was flown within Golden Valley County in 2017 relative to 2016 aerial surveys. WSBW-caused defoliation was the primary insect agent detected in the county, yet fewer acres were detected relative to the prior year. This may be due in part to the impacts of 2017 wildfires and smoke conditions that occurred throughout the state limiting visibility and ability to detect defoliation during surveys.

## Granite County

### Forestland, Mortality, and Defoliation Acres by Ownership

	<i><b>National Forest</b></i>	<i><b>Other Federal</b></i>	<i><b>Private</b></i>	<i><b>State</b></i>	<i><b>Total</b></i>
<b>Forestland</b>	600,007	27,980	161,370	33,141	822,498
<b>DFB</b>	20	14	12	2	50
<b>MPB</b>	126	6	12	2	146
<b>ESB</b>	0	0	2	0	2
<b>PE</b>	14	0	4	2	20
<b>Root Disease/Beetle Complex</b>	368	0	2	0	370
<b>WSBW</b>	23,610	633	905	40	25,188

Over a million acres were surveyed in both 2016 and 2017 with limited insect activity; less than 150 acres of MPB and 50 acres of DFB. Acres impacted by WSBW decreased by half from past numbers; smoke across the state due to wildfires made detection of defoliation more difficult possibly accounting for decrease. The only mortality of note was in SAF, attributable to a complex of agents including root disease, WBBB, and often, drought. Over 350 acres of mortality were detected.

Common root diseases found in this county include Heterobasidion root disease in firs, Armillaria root disease, schweinitzii root and butt rot, and tomentosus root rot. DF and true firs are most affected by the first three root diseases and Spruce, SAF, and DF are most affected by tomentosus root rot. Heterobasidion root disease is known to occur in PP.

Elytroderma needle disease is a significant agent in PP in localized areas. LPPDM and WLDM are present in this county

## Hill County

### Forestland, Mortality, and Defoliation Acres by Ownership

	<i>National Forest</i>	<i>Other Federal</i>	<i>Private</i>	<i>State</i>	<i>Total</i>
<b>Forestland</b>	0	0	34,285	0	34,285
<b>DFB</b>	0	45	10	2	57
<b>MPB</b>	0	8	10	0	18
<b>PE</b>	0	4	2	0	6
<b>Unknown</b>	0	10	22	7	39
<b>WSBW</b>	0	0	46	0	46

Approximately the same area was flown in both 2016 and 2017 with no insect activity noted of particular concern and no acre estimates of individual agent damage over 60 acres.

Dieback of QA was observed on 39 acres in seven polygons spread through the center and southern end of the Bear Paw Mountains. Schweinitzii root and butt rot and low levels of Armillaria root disease can be found in stands near Bailey Mountain and in the general area of the West Fork Beaver Creek in the southern portion of Rocky Boy's IR. Red ray rot is very common in PP on private lands bordering the reservation. LPPDM is common in many stands. Elytroderma needle blight is impacting LPP in the West Fork Beaver Creek drainage.

## Jefferson County

### Forestland, Mortality, and Defoliation Acres by Ownership

	<i>National Forest</i>	<i>Other Federal</i>	<i>Private</i>	<i>State</i>	<i>Total</i>
<b>Forestland</b>	422,971	71,840	135,441	13,909	644,161
<b>DFB</b>	46	4	6	2	58
<b>MPB</b>	35	4	12	0	51
<b>PE</b>	2	2	6	0	10
<b>Root Disease/Beetle Complex</b>	69	0	3	0	72
<b>Unknown</b>	6	0	45	0	51
<b>Wind-Tornado</b>	239	0	0	0	239
<b>WSBW</b>	9,665	1,194	3,088	380	14,327

Approximately the same area was flown in both 2016 and 2017 with no insect activity noted of particular concern. The most active insect, WSBW, damage decreased by half of impacted acres in 2016. Smoke across the state due to wildfires that made detection of defoliation more difficult may account for some of the decrease.

One 50 acre polygon of QA dieback was detected at the head of Corral Creek about six miles ESE of East Helena. About 240 acres of blowdown in multiple trees species was observed two miles southeast of Cottonwood Lake. LPPDM is present in this county. WPBR has been found on LP in this county.

## Judith Basin County

### Forestland, Mortality, and Defoliation Acres by Ownership

	<i>National Forest</i>	<i>Other Federal</i>	<i>Private</i>	<i>State</i>	<i>Total</i>
<b>Forestland</b>	276,919	0	23,816	6,430	307,164
<b>DFB</b>	568	0	10	2	580
<b>MPB</b>	50	0	14	0	64
<b>Root Disease/Beetle Complex</b>	28	0	0	0	28
<b>ESB</b>	44	0	0	0	44
<b>WSBW</b>	5,068	112	102	6	5,188
<b>WPBR</b>	28	0	0	0	28

Approximately half a million acres were flown in 2017, down slightly from 2016. Overall, insect activity has decreased to low levels with MPB under 100 acres and WSBW to around 5,000 acres. Smoke across the state due to wildfires made detection of defoliation more difficult. This may account for the large decrease in defoliation. An early survey date may partially account for the decrease in WSBW defoliation visible from the air. However, DFB activity did increase significantly to over 500 acres from 50 acres in 2016. It must be noted that DFB activity can be under reported as the activity can be masked by WSBW defoliation.

Three acres of QA dieback were detected about two miles west of Peterson Mountain. WPBR is common in LP. Armillaria root disease is significant in localized areas. Tomentosus root rot is known to be significant in some campgrounds. LPPDM is present in this county.

## Lake County

### Forestland, Mortality, and Defoliation Acres by Ownership

	<i>National Forest</i>	<i>Other Federal</i>	<i>Private</i>	<i>State</i>	<i>Total</i>
<b>Forestland</b>	159,359	0	340,063	44,761	544,183
<b>DFB</b>	296	585	6	18	1,499
<b>FE</b>	51	385	30	23	489
<b>MPB</b>	51	92	2	2	147
<b>PE</b>	0	11	0	0	11
<b>Root Disease/Beetle Complex</b>	33	39	6	0	78
<b>WPB</b>	0	6	0	2	8
<b>WSBW</b>	327	1,500	3	2	1,832

Less area was flown within Lake County in 2017 compared to the 2016 coverage. WSBW-caused defoliation continued in 2017 although acres mapped decreased substantially from the previous year. The decrease may be a result of the impacts of the 2017 wildfires and smoke conditions that occurred

throughout the state limiting visibility and ability to detect defoliation during surveys. DFB and FE were active at low levels within areas surveyed.

WPBR is common in both WWP and WBP. Root diseases are common in counties west of the Continental Divide. The more common ones known to occur in this county are Heterobasidion root disease in firs, Armillaria root disease, and schweinitzii root and butt rot. The tree species most affected are DF and true firs. Heterobasidion root disease is known to occur in PP. Elytroderma needle blight is a significant agent in PP in localized areas in the county, as noted by ADS. DFDM, LPPDM, and WLDM are present in this county.

## Lewis and Clark County

### Forestland, Mortality, and Defoliation Acres by Ownership

	<i>National Forest</i>	<i>Other Federal</i>	<i>Private</i>	<i>State</i>	<i>Total</i>
<b>Forestland</b>	947,318	59,141	347,581	32,071	1,386,110
<b>DFB</b>	2,532	18	261	48	2,859
<b>MPB</b>	113	8	49	6	176
<b>PE</b>	10	6	50	28	94
<b>Root Disease/Beetle Complex</b>	222	0	10	0	232
<b>Unknown</b>	19	0	34	0	53
<b>WSBW</b>	33,348	2,586	4,901	1,625	42,460

There was a significant increase in the area surveyed in Lewis and Clark County in 2017 compared to the area flown in 2016. WSBW and DFB activity both increased substantially from 2016 levels. WSBW-caused defoliation was mapped primarily in the northern portion of the county while DFB-caused mortality was mapped in the center.

About 52 acres of QA dieback were observed, with about 11 acres 1.5 miles SSE of Diversion Dam, 28 acres 1.5 miles SSW of McCarty Hill, seven acres one mile east of Lime Kiln Mountain, and six acres two miles east of Roberts Mountain. Armillaria root disease is present in the southeastern portion of the county, and schweinitzii root and butt rot is quite common, causing significant decay in butt logs of larger, older DF. WPBR is common in WBP and LP. LPPDM is common in this county.

## Liberty County

WPBR occurs in LP and WBP on East Butte of the Sweetgrass Hills. LPPDM is present in this county.

## Lincoln County

### Forestland, Mortality, and Defoliation Acres by Ownership

	<i>National Forest</i>	<i>Other Federal</i>	<i>Private</i>	<i>State</i>	<i>Total</i>
<b>Forestland</b>	1,729,899	0	401,054	47,984	2,178,937
<b>BWA</b>	153	0	0	0	153
<b>DFB</b>	1,681	0	29	14	1,724
<b>FE</b>	438	0	30	120	588
<b>Flooding</b>	2	0	0	0	2
<b>Larch Needle Cast</b>	1,747	0	4	49	1,800
<b>Marssonina Blight</b>	536	0	14	0	550
<b>MPB-LPP</b>	601	0	9	0	610
<b>MPB-PP</b>	45	0	0	2	47

<b>MPB-HE5NP</b>	6	0	0	0	6
<b>Mud-Land Slide</b>	87	0	0	0	87
<b>PE</b>	8	0	0	0	8
<b>IPS (Pinyon)</b>	2	2	0	0	4
<b>Root Disease/Beetle Complex</b>	3,412	318	64	24	3,820
<b>ESB</b>	25	0	3	0	28
<b>Unknown</b>	9	137	45	0	191
<b>WPB</b>	24	0	4	0	28
<b>WSBW</b>	731	0	83	0	814
<b>WPBR</b>	903	0	0	24	927

Over 1.7 million acres were flown in 2017, 30% decrease from the 2016 survey area. The southeast portion of the county was not surveyed in 2017. This decrease in survey area may account for the decrease in DFB to approximately 1,700 acres. This is down from over 3,000 acres in 2016, yet remains one of the most substantial areas of DFB activity in Montana. FE is also down from nearly 2,000 acres to nearly 600 acres, and WSBW decreased to 800 acres from over 5,000 in 2016. However, MPB in LPP showed an increase to 610 acres and SAF mortality/damage increased to nearly 1,500 acres attributable to both BWA and a complex of agents that includes root disease and WBBB.

Over 1,800 acres of LNC were detected spread throughout the area surveyed in the county. WPBR is common in WWP and WBP. DFD, LPPDM, and WLDM are present. Elytroderma needle disease causes moderate damage in PP in some locations. Atropellis cankers are present in many LPP east of Lake Koocanusa.

Root diseases are common in counties west of the Continental Divide. The more common root diseases known to occur in this county are fir-type Heterobasidion root disease, Armillaria root disease, laminated root disease, and schweinitzii root and butt rot. The tree species most affected are DF and true firs. Heterobasidion root disease is known to occur in PP.

## Madison County

### Forestland, Mortality, and Defoliation Acres by Ownership

	<i>National Forest</i>	<i>Other Federal</i>	<i>Private</i>	<i>State</i>	<i>Total</i>
<b>Forestland</b>	592,485	103,957	175,620	13,957	886,020
<b>BWA</b>	2	0	0	0	2
<b>DFB</b>	57	7	6	2	72
<b>MPB-LPP</b>	96	14	2	2	114
<b>MPB-HE5NP</b>	138	0	4	0	142
<b>Root Disease/Beetle Complex</b>	850	89	30	6	968
<b>SB</b>	31	0	0	0	31
<b>Unknown</b>	10	0	5	51	66
<b>WSBW</b>	22,270	4,815	5,720	736	33,541
<b>WPBR</b>	236	0	2	0	238
<b>Wind Tornado</b>	5	0	0	0	5

Over 1.7 million acres were flown in 2017, up slightly from 2016 and covering much of the same area. Insect damage remained low with MPB killing around 250 acres, DFB under 75 acres, and SB around 30 acres. The only increase in mortality was detected in SAF due to a complex of agents that usually includes drought, root disease



and WBBB. This is one of the few counties in the state where WSBW defoliation levels did not show a significant decrease.

One 10-acre polygon of QA dieback was detected up Freezeout Creek about 2 miles from the junction with Madison River. Five acres of blowdown were detected 2.5 miles WSW of Baldy Mountain. WPBR is common in WBP and LP. LPDM is present in this county. Schweinitzii root and butt rot is affecting 100 plus year old DF stands.

## Meagher County

### Forestland, Mortality, and Defoliation Acres by Ownership

	<i>National Forest</i>	<i>Other Federal</i>	<i>Private</i>	<i>State</i>	<i>Total</i>
<b>Forestland</b>	445,927	6,816	200,709	13,472	666,924
<b>DFB</b>	932	6	1,018	0	1,956
<b>MPB</b>	52	0	22	0	74
<b>PE</b>	2	0	0	0	2
<b>Root Disease/Beetle Complex</b>	350	0	0	0	350
<b>SB</b>	4	0	4	0	8
<b>WSBW</b>	15,063	227	9,580	171	25,041
<b>WPBR</b>	2	0	0	0	2

Similar portions of Meagher County were flown during 2016 and 2017 aerial surveys. Acres mapped with DFB-caused mortality increased substantially within the northwestern portion of the county. The area mapped with WSBW decreased due in part to the impacts of 2017 wildfires and smoke conditions that occurred throughout the state limiting visibility and ability to detect defoliation during surveys.

Tomentosus root rot and Schweinitzii root and butt rot are damaging older ES and DF in localized areas. WPBR is common in WBP and LP. LPPDM is present and damaging LPP in this county, as are Comandra blister rust and Atropellis canker.

## Mineral County

### Forestland, Mortality, and Defoliation Acres by Ownership

	<i>National Forest</i>	<i>Other Federal</i>	<i>Private</i>	<i>State</i>	<i>Total</i>
<b>Forestland</b>	630,827		68,591	20,604	720,022
<b>BWA</b>	1,197		0	0	1,197
<b>DFB</b>	52		0	0	52
<b>FE</b>	1,285		62	26	1,373
<b>Larch Needle Cast</b>	80		0	0	80
<b>Larch Sawfly</b>	571		26	0	596
<b>MPB</b>	209		8	0	217
<b>Root Disease/Beetle Complex</b>	50		0	0	50
<b>ESB</b>	66		0	0	66
<b>WSBW</b>	1,125		12	0	1,137
<b>WPBR</b>	8		0	0	8

Only the far northern portion of Mineral County was flown during the 2017 aerial survey season due to wildfire smoke, a reduced area compared to that flown in 2016. Regardless, an increase was detected in acres mapped for both FE and BWA-caused tree mortality in 2017. WSBW continued to cause defoliation

in the area surveyed. Additionally, western larch sawfly was detected defoliating WL trees within Mineral County.

Approximately 80 acres of LNC were observed in five polygons on the north end of the county. WPBR is common in WWP and WBP. The more common root diseases known to occur in this county are fir-type Heterobasidion root disease, Armillaria root disease, laminated root disease, and schweinitzii root and butt rot. DF and true-firs are the conifers most effected. Tomentosus root rot has been found impacting WL heavily infected with WLDM. Heterobasidion is known to occur in PP. DFDM, LPPDM, and WLDM are also present in this county.

## Missoula County

### Forestland, Mortality, and Defoliation Acres by Ownership

	<i>National Forest</i>	<i>Other Federal</i>	<i>Private</i>	<i>State</i>	<i>Total</i>
<b>Forestland</b>	651,948	21,044	605,829	126,487	1,405,307
<b>BWA</b>	23	0	0	0	23
<b>DFB</b>	18	6	1	0	25
<b>MPB</b>	59	2	37	8	106
<b>PE</b>	2	0	8	6	16
<b>Root Disease/Beetle Complex</b>	10	31	0	4	45
<b>WSBW</b>	5,666	605	2,600	2	8,873

The western portion of Missoula County was not flown in 2017 because of smoke and restricted flight paths due to the 2017 wildfires. Subsequently less than half the area surveyed in 2016 was covered during the 2017 flights. WSBW defoliation continued in the DF host throughout the survey area. Other insects, including BWA, DFB, and PE were detected, but minimal acres were mapped.

Root diseases are common in counties west of the Continental Divide. The more common root diseases known to occur in this county are Heterobasidion root disease in firs, Armillaria root disease, laminated root disease, and schweinitzii root and butt rot. The tree species most affected are DF and true firs. Heterobasidion root disease is known to occur in PP. WPBR is common in both WWP and WBP. Elytroderma needle blight is a significant agent in PP in localized areas in this county. Comandra blister rust and western gall rust are common in PP, as are DFDM, LPPDM, and WLDM in their respective hosts.

## Musselshell County

Only the northwestern tip of Musselshell County was flown in 2017 with no notable pest activity reported.

## Park County

### Forestland, Mortality, and Defoliation Acres by Ownership

	<i>National Forest</i>	<i>Other Federal</i>	<i>Private</i>	<i>State</i>	<i>Total</i>
<b>Forestland</b>	717,518	73,375	190,718	26,794	1,008,405
<b>DFB</b>	81	2	40	0	103
<b>MPB</b>	340	2	11	2	357
<b>Root Disease/Beetle Complex</b>	50	6	2	0	58
<b>WSBW</b>	28,202	834	12,555	389	41,980
<b>Wind-Tornado</b>	25	0	0	0	25

Similar areas were flown in Park County during 2017 relative to the 2016 aerial surveys. WSBW-caused defoliation was detected throughout the county and increased roughly two-fold compared to 2016 acres mapped. Other insects, DFB and MPB, were mapped at minimal levels.

Forty-six acres of QA dieback were detected in the northcentral part of the county. One forty-two acre polygon was detected 2.5 miles northwest of Porcupine Guard Station and one 4 acre polygon was detected about three miles north of that guard station. Twenty five acres of blowdown in all tree species were detected two miles southwest of Fairview Peak.

WPBR is common in WBP and LP stands. Tomentosus root rot and schweinitzii root and butt rot are known to be significant in some campgrounds. LPPDM is present in Park County.

## Phillips County

### Forestland, Mortality, and Defoliation Acres by Ownership

	<i>National Forest</i>	<i>Other Federal</i>	<i>Private</i>	<i>State</i>	<i>Total</i>
<b>Forestland</b>	0	96,621	40,352	3,363	140,336
<b>MPB</b>	0	56	0	0	56

Over 100,000 acres were flown in both 2016 and 2017 detecting limited MPB activity each year; less than 60 acres were recorded in 2017.

Western gall rust and Comandra blister rust are common in PP on the Fort Belknap IR causing stem deformities, branch mortality, top kill, and occasional whole tree mortality. Armillaria root disease can be found on the Fort Belknap IR, in the Mission Canyon area, with large pockets developing in DF and QA. LPPDM is present in this county.

## Pondera County

In 2017 16% of the area surveyed in 2016 was revisited, primarily along the western edge of the border with Teton County. Nevertheless, no more than 16 acres were attributable to any one damage agent in either year; no WSBW activity was noted although smoke in the area could have made detection difficult.

WPBR is common in WBP and LP in this county.

## Powell County

### Forestland, Mortality, and Defoliation Acres by Ownership

	<i>National Forest</i>	<i>Other Federal</i>	<i>Private</i>	<i>State</i>	<i>Total</i>
<b>Forestland</b>	635,503	74,015	243,278	29,496	982,293
<b>DFB</b>	90	780	59	20	949
<b>MPB</b>	14	5	16	15	50
<b>PE</b>	0	6	18	4	28
<b>Root Disease/Beetle Complex</b>	61	66	0	0	127
<b>WSBW</b>	6,194	3,359	1,332	919	11,804
<b>Wind-Tornado</b>	155	0	0	0	155

Slightly less area was flown in Powell County in 2017 relative to the area covered in the 2016 aerial surveys. WSBW-caused defoliation continues in DF. Though fewer acres were mapped in 2017 compared to those in 2016. This may be due in part to the impacts of 2017 wildfires and smoke conditions that occurred throughout the state limiting both visibility and the ability to detect defoliation during surveys. There was a substantial increase in DFB-caused mortality in 2017 compared to 2016.

About 155 acres of wind thrown LPP were detected on Racetrack Creek in the southwest corner of the county. Quaking aspen dieback was observed on about 27 acres total, with 14 acres of those occurring 1.5 miles ESE of Saddle Mountain, 8 acres observed one mile ESE of Mud Lake, and 6 acres about 1.5 miles southwest of the reservoir on Spotted Dog Creek.

Root diseases are common in counties west of the Continental Divide. The more common ones known to occur in this county are fir-type Heterobasidion root disease, Armillaria root disease, and schweinitzii root and butt rot. The tree species most affected are DF and true firs. Tomentosus root rot has been found in > 100 year old spruce. WPBR is common in WBP and LP. LPPDM is present in this county.

## Ravalli County

### Forestland, Mortality, and Defoliation Acres by Ownership

	<i>National Forest</i>	<i>Other Federal</i>	<i>Private</i>	<i>State</i>	<i>Total</i>
<b>Forestland</b>	1,071,976	0	120,837	27,009	1,219,822
<b>DFB</b>	871		16	5	893
<b>MPB</b>	50		4	6	60
<b>PE</b>	7		44	14	65
<b>Root Disease/Beetle Complex</b>	212		0	0	212
<b>ESB</b>	14		0	0	14
<b>WSBW</b>	36,168		3,781	1,231	41,180
<b>WPBR</b>	49		0	0	49

Over 1 million acres were flown in 2017, a 33% decrease from the area surveyed in 2016. This decrease in acres surveyed may account for some of the decrease in damage agent activity. However, both DFB and WSBW activity increased in 2017; nearly 900 acres of DFB and over 41,000 acres of WSBW (a doubling of acres impacted) were detected.

DF and true firs are most affected by common root diseases in this county including Heterobasidion root disease, Armillaria root disease, laminated root disease, and schweinitzii root and butt rot. Heterobasidion root disease is known to occur in PP in the foothills of both the Bitterroot and Sapphire Mountains. Tomentosus root rot is occasionally observed in ES. WPBR is common in WBP. Notable levels of comandra blister rust cause top kill in PP in the foothills of the Bitterroot Mountains. Elytroderma needle blight is a significant agent in localized areas in this county; high levels continue to exist in the area around Lake Como. DFDM, LPPDM, and WLDM are present in the county, with DFDM being quite common in the lower elevations of the Sapphire and Bitterroot Mountains.

## Rosebud County

Aerial surveys did not cover this county in 2017 and no information was submitted documenting conditions from ground surveys.

## Sanders County

### Forestland, Mortality, and Defoliation Acres by Ownership

	<i>National Forest</i>	<i>Other Federal</i>	<i>Private</i>	<i>State</i>	<i>Total</i>
<b>Forestland</b>	941,349	6,656	423,104	55,697	1,426,805
<b>BWA</b>	239	0	8	0	247
<b>DFB</b>	2,494	10	139	71	2,714
<b>FE</b>	2,919	363	243	345	3,870
<b>Larch Needle Cast</b>	1,727	0	132	9	1,868
<b>Larch Sawfly</b>	558	0	4	0	562
<b>MPB</b>	2,385	213	56	77	2,731
<b>PE</b>	6	2		0	8
<b>Root Disease/Beetle Complex</b>	233	2	17	4	256
<b>WPB</b>	24	14	10	0	48
<b>WSBW</b>	2,957	735	207	125	4,025
<b>WPBR</b>	66	0	37	23	126

In 2017 slightly less area was flown in Sanders County relative to the 2016 aerial surveys. DFB remained active causing similar levels of mortality throughout the county as detected in prior years. FE-caused mortality within GF increased substantially in 2017. MPB-caused mortality in LPP continues in isolated locations at levels comparable to 2016. WSBW affected area decreased; however, this may be due in part to the impact of 2017 wildfires and smoke conditions that restricted flight paths and limited the ability to detect defoliation during surveys.

Nearly 1,900 acres of LNC were scattered throughout the county with the greatest concentration in the northwest. A few areas of LNC were observed SSE of Thompson Falls. Flooding was observed about one-third of a mile up Little Thompson River damaging approximately two acres of trees.

Root diseases known to occur in this county are Heterobasidion root disease, Armillaria root disease, laminated root disease, and schweinitzii root and butt rot. The tree species most affected are DF and true firs. Heterobasidion root disease is known to occur in PP, while tomentosus root rot is known to occur in localized areas in the county, affecting DF and ES. WPBR is common in both WWP and WBP. DFDM, LPPDM, and WLDM are present and common in this county.

## Silver Bow County

### Forestland, Mortality, and Defoliation Acres by Ownership

	<i>National Forest</i>	<i>Other Federal</i>	<i>Private</i>	<i>State</i>	<i>Total</i>
<b>Forestland</b>	149,885	22,340	70,365	6,275	248,865
<b>DFB</b>	6	8	2	4	20
<b>MPB</b>	8	2	4	0	14
<b>Root Disease/Beetle</b>	16	0	0	0	16

<b>Complex WSBW</b>	5,855	1,417	535	437	8,244
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Approximately the same acreage was flown in 2016 and 2017 with no insect activity of particular concern detected. WSBW, the most active pest, still showed a 30% decrease in affected acres from 2016 to 2017. Smoke across the state due to wildfires made detection of defoliation difficult while also restricting flight paths possibly accounting for some of this decrease.

About 30 acres of QA dieback were observed along Fly Creek about 6 miles ENE of the Continental Divide. This is about 5 acres more than detected along the creek in 2016.

White pine blister rust is common in whitebark pine and limber pine in this county.

## Sweet Grass County

### Forestland, Mortality, and Defoliation Acres by Ownership

	<i>National Forest</i>	<i>Other Federal</i>	<i>Private</i>	<i>State</i>	<i>Total</i>
<b>Forestland</b>	253,917	11,016	145,038	4,108	414,078
<b>DFB</b>	0		48	0	48
<b>WSBW</b>	2,386		4,968	155	7,509

Flown areas were limited to only the northwestern portion of Sweet Grass County in 2017, resulting in half as much area surveyed relative to 2016. WSBW-caused defoliation within DF host trees occurred throughout the area surveyed. Other insects were mapped at minimal levels.

Eight acres of QA dieback were observed on Cort Creek about three miles ESE of Kid Roy Mountain. WPBR has been found in WBP and LP in the county. Tomentosus root rot and schweinitzii root and butt rot affect over-mature conifers in this county.

## Teton County

### Forestland, Mortality, and Defoliation Acres by Ownership

	<i>National Forest</i>	<i>Other Federal</i>	<i>Private</i>	<i>State</i>	<i>Total</i>
<b>Forestland</b>	55,823	0	24,423	0	80,245
<b>DFB</b>	20	8	2	2	20
<b>MPB</b>	119	4	4	2	129
<b>Root Disease/Beetle Complex</b>	300	4	0	0	304
<b>SB</b>	4	10	0	2	16
<b>WSBW</b>	11,959	2,999	1,643	1,175	17,776

Only the western portion of Teton County was flown in 2017. In this area, increased acres were surveyed in 2017 relative to 2016. WSBW-caused defoliation occurred throughout the area surveyed with substantially increased acres mapped relative to the prior year. Other insects were mapped at minimal levels.

Over 220 acres of QA dieback were detected with 69 acres observed just south of the Teton River about two miles north of Pine Butte. The remainder of QA dieback was scattered in the northwest part of the county between the headwaters of Lenstra Creek and Dupuyer Creek.

WPBR is common in WBP and LP in this county. Armillaria root disease causes conifer and QA mortality. Tomentosus root rot and schweinitzii root and butt rot are causing damage in over mature conifers in parts of this county.

## Toole County

Aerial surveys did not cover this county in 2017 and no information was submitted documenting conditions from ground surveys.

## Wheatland County

### Forestland, Mortality, and Defoliation Acres by Ownership

	<i>National Forest</i>	<i>Other Federal</i>	<i>Private</i>	<i>State</i>	<i>Total</i>
<b>Forestland</b>	55,823	0	24,423	0	80,245
<b>MPB</b>	24	0	6	0	30
<b>WSBW</b>	2,040	0	261	27	2,328

Two-thirds of the area flown in 2016 were resurveyed in 2017; decreased coverage occurred in both the northeast corner and southwest corner of the county (Big Snowy and Crazy Mountains, respectively). In both years, bark beetle activity remained low; under 50 acres for MPB and under 5 acres for DFB. The most active insect, WSBW, affected 10% of 2016 impacted acreage. Smoke across the state due to wildfires made detection of defoliation difficult and restricted flight paths possibly accounting for some of the decrease in activity.

WPBR occurs in Wheatland County.

**Table 1. Forest Mortality, Defoliation, and Other Damage on Montana National Forests and Tribal Lands, 2017**

Administrative Unit/Damage Agent	Severity *			
<b>BEAVERHEAD-DEER LODGE NF</b>				
<b>BUTTE RD</b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
Douglas-fir Beetle	4			4
Mountain Pine Beetle (LPP)	4			4
Mountain Pine Beetle (PP)	2			2
Mountain Pine Beetle (HE5NP)	0			0
Root Disease/Beetle Complex	6			6
Western Spruce Budworm	1,343		2,485	3,828
White Pine Blister Rust	2			2
<b>DILLON RD</b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
Douglas-fir Beetle	34	2		36
Mountain Pine Beetle (LPP)	335	2		337
Mountain Pine Beetle (HE5NP)	64			64
Root Disease/Beetle Complex	40	2		42
Western Spruce Budworm	4			4
<b>JEFFERSON RD</b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
Douglas-fir Beetle	56	25		81
Mountain Pine Beetle (LPP)	28			28
Root Disease/Beetle Complex	52	27		79
Western Spruce Budworm	8,293		6,314	14,607
<b>MADISON RD</b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
Douglas-fir Beetle	21			21
Mountain Pine Beetle (LPP)	98			98
Mountain Pine Beetle (HE5NP)	77	69		146
Root Disease/Beetle Complex	417	46		463
Western Spruce Budworm	7,193		13,701	20,894
White Pine Blister Rust	131		86	217
Wind - Tornado/Hurricane			5	5
<b>PINTLER RD</b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
Douglas-fir Beetle	14			14
Mountain Pine Beetle (LPP)	568			568
Mountain Pine Beetle (PP)	8			8
Mountain Pine Beetle (HE5NP)	56	2		58
Root Disease/Beetle Complex	368		4	372
Western Spruce Budworm	5,857		8,624	14,481
Wind-Tornado/Hurricane			155	155
<b>WISDOM RD</b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
Douglas-fir Beetle	6			6
Mountain Pine Beetle (LPP)	24			24
Mountain Pine Beetle (PP)	2			2
Mountain Pine Beetle (HE5NP)	12			12
Root Disease/Beetle Complex	66			66
Spruce Beetle	4			4
Western Spruce Budworm	617			617
<b>WISE RIVER RD</b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
Douglas-fir Beetle	2			2
Mountain Pine Beetle (LPP)	20			20
Mountain Pine Beetle (PP)	13	34		47
Mountain Pine Beetle (HE5NP)	6			6
Root Disease/Beetle Complex	22			22
Western Spruce Budworm	848		6,429	7,277



<b>Administrative Unit/Damage Agent</b>	<b>Severity *</b>			
<b>BITTERROOT NF</b>				
<b>DARBY RD</b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
Douglas-fir Beetle	19		2	21
Mountain Pine Beetle (LPP)	2			2
<b>DARBY RD</b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
Mountain Pine Beetle (PP)	14			14
Pine Engraver	7			7
Root Disease/Beetle Complex	63			63
Spruce Beetle	6			6
Western Spruce Budworm	446		7,012	7,558
<b>STEVENSVILLE RD</b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
Douglas-fir Beetle	6			6
Mountain Pine Beetle (LPP)	8			8
Mountain Pine Beetle (HE5NP)	2			2
Pine Engraver	4			4
Root Disease/Beetle Complex	14			14
Western Spruce Budworm	704		9,559	10,263
<b>SULA RD</b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
Douglas-fir Beetle	15			15
Mountain Pine Beetle (LPP)	4			4
Mountain Pine Beetle (PP)	10			10
Pine Engraver	2			2
Root Disease/Beetle Complex	16			16
Western Spruce Budworm	35		9,053	9,088
White Pine Blister Rust	49			49
<b>WEST FORK RD</b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
Douglas-fir Beetle	265	309	256	830
Mountain Pine Beetle (LPP)	4			4
Mountain Pine Beetle (PP)	6			6
Mountain Pine Beetle (HE5NP)	4			4
Root Disease/Beetle Complex	119			119
Spruce Beetle	4			4
Western Spruce Budworm	526		11,214	11,740
<b>CUSTER-GALLATIN NF</b>				
<b>BOZEMAN RD</b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
Douglas-fir Beetle	102	34		136
Mountain Pine Beetle (LPP)	55	52		104
Mountain Pine Beetle (PP)	2			2
Mountain Pine Beetle (HE5NP)	73			73
Root Disease/Beetle Complex	284	434	4	726
Spruce Beetle	6			6
Western Spruce Budworm	15,109		7,260	22,369
White Pine Blister Rust	13	42		45
<b>GARDINER RD</b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
Mountain Pine Beetle (LPP)	10			10
Mountain Pine Beetle (HE5NP)	26			26
Root Disease/Beetle Complex	46			46
Western Spruce Budworm	11,665		783	12,448
<b>HEBGEN LAKE RD</b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
Balsam Woolly Adelgid	220			220
Mountain Pine Beetle (LPP)	28	2		30
Mountain Pine Beetle (HE5NP)	8			8
Root Disease/Beetle Complex	342	107	4	453
Western Spruce Budworm	928		248	1,176

<b>Administrative Unit/Damage Agent</b>	<b>Severity*</b>			
<b>FLATHEAD NF</b>				
<b>HEGBEN LAKE RD</b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
White Pine Blister Rust	57			57
<b>YELLOWSTONE RD</b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
Douglas-fir Beetle	20		2	22
Mountain Pine Beetle (LPP)	8		6	14
Mountain Pine Beetle (HE5NP)	251			251
Root Disease/Beetle Complex	28	15		43
Western Spruce Budworm	23,421		1,720	25,141
Wind-Tornado/Hurricane	25			25
<b>GLACIER RD</b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
Balsam Woolly Adelgid	2			2
Douglas-fir Beetle	30			30
Drought	153			153
Fir Engraver	10			10
Larch Needle Cast	52	446	584	1,082
Mountain Pine Beetle (LPP)	10			10
Mountain Pine Beetle (PP)	4			4
Mountain Pine Beetle (HE5NP)	2			2
Root Disease/Beetle Complex	281	110	35	426
Spruce Beetle	2			2
Western Spruce Budworm	938			938
White Pine Blister Rust	19			19
<b>HUNGRY HORSE RD</b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
Douglas-fir Beetle	263	106	60	429
Fir Engraver	8			8
Larch Needle Cast	5	89		94
Mountain Pine Beetle (LPP)	12			12
Root Disease/Beetle Complex	77	4		81
Western Spruce Budworm	1,028			1,028
<b>SPOTTED BEAR RD</b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
Douglas-fir Beetle	151	2		153
Larch Needle Cast	96	10		106
Mountain Pine Beetle (LPP)	190	160	185	535
Mountain Pine Beetle (PP)	8			8
Root Disease/Beetle Complex	18			18
Western Pine Beetle	2			2
Western Spruce Budworm	916			916
<b>SWAN LAKE RD</b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
Douglas-fir Beetle	154	8		162
Fir Engraver	49	22		71
Mountain Pine Beetle (LPP)	10			10
Mountain Pine Beetle (PP)	2			2
Root Disease/Beetle Complex	20			20
Western Spruce Budworm	213			213
<b>TALLY LAKE RD</b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
Douglas-fir Beetle	551	84	81	716
Drought	90			90
Fir Engraver	6			6
Larch Needle Cast	589	735	988	2,312
Mountain Pine Beetle (LPP)	6			6
Root Disease/Beetle Complex	40			40
Western Spruce Budworm	204			204

<b>Administrative Unit/Damage Agent</b>	<b>Severity*</b>			
<b>HELENA-LEWIS &amp; CLARK NF</b>				
<b>BELT CREEK /WHITE SULPHUR SPRINGS</b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
Douglas-fir Beetle	971	435	28	1,434
Mountain Pine Beetle (LPP)	275	2		277
Mountain Pine Beetle (PP)	10			10
Mountain Pine Beetle (HE5NP)	8			8
Root Disease/Beetle Complex	330			330
Spruce Beetle	6			6
Western Spruce Budworm	5,117		7,754	12,871
White Pine Blister Rust	4		98	102
<b>HELENA RD</b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
Douglas-fir Beetle	95			95
Mountain Pine Beetle (LPP)	28	49		77
Mountain Pine Beetle (HE5NP)	4			4
<b>HELENA RD</b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
Root Disease/Beetle Complex	39	42		81
Western Spruce Budworm	12,171		15,377	27,548
<b>JUDITH-MUSSELSHELL RD</b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
Douglas-fir Beetle	278	16	8	302
Mountain Pine Beetle (LPP)	52			52
Mountain Pine Beetle (PP)	30			30
Mountain Pine Beetle (HE5NP)	40			40
Pine Engraver	32			32
Root Disease/Beetle Complex	62	2		64
Spruce Beetle	46			46
Western Spruce Budworm	8,848		4,028	12,876
White Pine Blister Rust	30			30
<b>LINCOLN RD</b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
Douglas-fir Beetle	386	131	424	941
Mountain Pine Beetle (LPP)	16	2		18
Mountain Pine Beetle (PP)	8			8
Pine Engraver	4			4
Root Disease/Beetle Complex	14	2		16
<b>LINCOLN RD</b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
Western Spruce Budworm	1,408		1,395	2,803
<b>TOWNSEND RD</b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
Douglas-fir Beetle	232	52		284
Mountain Pine Beetle (LPP)	2			2
Mountain Pine Beetle (PP)	16			16
Mountain Pine Beetle (HE5NP)	8			8
Pine Engraver	8			8
Root Disease/Beetle Complex	36	2		38
Spruce Beetle	2			2
Western Spruce Budworm	789	3,223		4,012
<b>KOOTENAI NF</b>				
<b>CABINET RD</b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
Balsam Woolly Adelgid	159			159
Douglas-fir Beetle	1,183	243	25	1,451
Fir Engraver	1,661			1,661
Larch Needle Cast	569	519	669	1,757
Larch Sawfly	409			409
Mountain Pine Beetle (LPP)	751	190	19	960
Mountain Pine Beetle (PP)	369			369

Administrative Unit/Damage Agent	Severity*			
	Low	Moderate	High	Total Acres
<b>CABINET RD</b>				
Mountain Pine Beetle (HE5NP)	4			4
Pine Engraver	2			2
Root Disease/Beetle Complex	22			22
Western Pine Beetle	8			8
Western Spruce Budworm	6			6
White Pine Blister Rust	57			57
<b>FORTINE RD</b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
Balsam Woolly Adelgid	14			14
Douglas-fir Beetle	459	221		680
Fir Engraver	27	2		29
Larch Needle Cast	75	59		134
Mountain Pine Beetle (LPP)	12	2		14
Mountain Pine Beetle (PP)	2			2
Mountain Pine Beetle (HE5NP)	2			2
Root Disease/Beetle Complex	423	4		427
Western Pine Beetle	2			2
Western Spruce Budworm	258			258
<b>LIBBY RD</b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
Douglas-fir Beetle	361	39	103	503
Fir Engraver	29			29
Larch Needle Cast	426	104		530
Mountain Pine Beetle (LPP)	118			118
Mountain Pine Beetle (PP)	9			9
Root Disease/Beetle Complex	4			4
Western Pine Beetle	6			6
White Pine Blister Rust	47			47
<b>REXFORD RD</b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
Douglas-fir Beetle	137	36		173
Fir Engraver	6			6
Larch Needle Cast	175	52		227
Mountain Pine Beetle (LPP)	86			86
Mountain Pine Beetle (PP)	2			2
Pine Engraver	2			2
Root Disease/Beetle Complex	227	2		229
Western Spruce Budworm	515			515
Western Pine Beetle	359			359
<b>THREE RIVERS RD</b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
Balsam Woolly Adelgid	11			11
Douglas-fir Beetle	510			510
Fir Engraver	458	63		521
Larch Needle Cast	546	220	163	929
Mountain Pine Beetle (LPP)	326	15		341
Mountain Pine Beetle (PP)	34			34
Mountain Pine Beetle (HE5NP)	4			4
Pine Engraver	2			2
Root Disease/Beetle Complex	526			526
Spruce Beetle	10			10
Western Pine Beetle	14			14
Western Spruce Budworm	71			71
White Pine Blister Rust	507			507
<b>LOLO NF</b>				
<b>MISSOULA RD</b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
Balsam Woolly Adelgid	23			23
Douglas-fir Beetle	16			16

Administrative Unit/Damage Agent	Severity*			
	Low	Moderate	High	Total Acres
<b>MISSOULA RD</b>				
Mountain Pine Beetle (LPP)	55	2		57
Mountain Pine Beetle (PP)	10			10
Mountain Pine Beetle (HE5NP)	4			4
Pine Engraver	14			14
Root Disease/Beetle Complex	6	2		8
Western Spruce Budworm	834	16,352		17,186
<b>NINEMILE RD</b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
Mountain Pine Beetle (LPP)	17			17
<b>PLAINS/THOMPSON FALLS RD</b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
Balsam Woolly Adelgid	2	9		11
Douglas-fir Beetle	828	330		1,158
Fir Engraver	1,318	2		1,320
Larch Needle Cast	59	34		93
Mountain Pine Beetle (LPP)	935	114		1,049
Mountain Pine Beetle (PP)	38			38
Pine Engraver	4			4
Root Disease/Beetle Complex	211			211
Spruce Beetle	0			0
Western Pine Beetle	16			16
Western Spruce Budworm	3,003			3,003
White Pine Blister Rust	37			37
<b>SEELEY LAKE RD</b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
Douglas-fir Beetle	16			16
Mountain Pine Beetle (LPP)	2			2
Root Disease/Beetle Complex	2			2
Western Spruce Budworm	1,399			1,399
<b>SUPERIOR RD</b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
Balsam Woolly Adelgid	209	461	526	1,196
Douglas-fir Beetle	66			66
Fir Engraver	1,372			1,372
Larch Needle Cast	71	9		80
Mountain Pine Beetle (LPP)	158	30		188
Mountain Pine Beetle (PP)	8			8
Root Disease/Beetle Complex	50			50
Spruce Beetle	67			67
Western Spruce Budworm	1,123			1,123
White Pine Blister Rust	8			8
<b>FLATHEAD IR</b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
Douglas-fir Beetle	309	293		602
Fir Engraver	747			747
Mountain Pine Beetle (LPP)	167	20		187
Mountain Pine Beetle (PP)	104			104
Pine Engraver		20		20
Root Disease/Beetle Complex	55	19		74
Western Pine Beetle	20			20
Western Spruce Budworm	2,737			2,737
<b>FORT BELKNAP IR</b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
Douglas-fir Beetle	6			8
Mountain Pine Beetle (LPP)	57			57
Mountain Pine Beetle (PP)	22	2		24
<b>ROCKY BOY'S IR</b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
Douglas-fir Beetle	64	13		77

Administrative Unit/Damage Agent				
ROCKY BOY'S IR	Low	Moderate	High	Total Acres
Mountain Pine Beetle (LPP)	10			10
Mountain Pine Beetle (PP)	2			2
Pine Engraver	6			6

\*Severity classes for non-defoliators defined as:

Severity	Percent Classes	# Tree Classes
Low	1-3, 4-10%	1, 2-5, 6-15
Moderate	11-29%	16-30
High	>30%	>30%

\*Severity classes for defoliators defined as:

	Percent Defoliation
Low	< 75%
High	75 – 100%

**Table 2. Host Type Infested by Bark Beetles on all Ownership Statewide, 2017 (Acres)**

INSECT <sup>1</sup>	USFS	OTHER FED	PRIVATE	STATE	TOTAL
BWA	1,833	-	8	-	1,841
DFB	12,377	1,747	2,085	394	16,603
FE	4,785	747	406	604	6,542
MPB-HE5NP	712	16	37	6	771
MPB-LPP	5,246	399	199	130	5,974
MPB-PP	617	187	280	54	1,138
MPB-WWP	10	20	-	-	30
PE	88	47	208	58	401
SB	190	5	9	8	212
WPB	52	20	16	2	90
WSBW	258,321	27,768	70,698	15,662	372,449

<sup>1</sup>BWA = Balsam Woolly Adelgid; DFB = Douglas-fir Beetle; FE = Fir Engraver Beetle; MPB-HE5NP = Mountain Pine Beetle in High Elevation 5-Needle Pines (WBP & LP); MPB-LPP = Mountain Pine Beetle in Lodgepole Pine; MPB-PP = Mountain Pine Beetle in Ponderosa Pine; MPB-WWP = Mountain Pine Beetle in Western White Pine; PE = Pine Engraver Beetle; SB = Spruce Beetle; WPB = Western Pine Beetle

**Table 3. Bark Beetle Infestations Statewide (total acres impacted and current severity) 2015-2017**

<b>INSECTS<sup>1</sup></b>	<b>2015</b>	<b>2016</b>	<b>2017</b>			
	<b>Acres</b>	<b>Acres</b>	<b>Acres</b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>
DFB	14,321	14,839	16,569	11,458	3,468	1,643
EIPS	-	-	2	2	-	-
FE	85	10,002	6,542	6,417	92	33
MPB	174,387	10,764	7,971	6,956	780	235
PE	1,281	2,140	10	10	-	-
SB	1,137	373	219	198	-	21
WPB	50	102	92	92	-	-
<b>Total</b>	<b>191,261</b>	<b>38,220</b>	<b>31,405</b>	<b>25,133</b>	<b>4,340</b>	<b>1,932</b>

<sup>1</sup> DFB = Douglas-Fir Beetle; EIPS = Emarginate Ips; FE = Fir Engraver Beetle; MPB = Mountain Pine Beetle; PE = Pine Engraver; SB = Spruce Beetle; WPB = Western Pine Beetle

**Table 4. Douglas-fir Beetle – Caused Mortality on all Ownerships Statewide, 2015-2017**

<b>Reporting Area</b>	<b>2015</b>	<b>2016</b>	<b>2017*</b>			
	<b>Acres</b>	<b>Acres</b>	<b>Acres</b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>
Beaverhead/Deerlodge	711	305	164	137	27	-
Bitterroot	408	620	879	307	313	260
Custer/Gallatin	665	111	122	86	34	2
Flathead	1,841	2,081	1,490	1,149	200	141
Garnets	103	-	-	-	-	-
Helena/Lewis & Clark	2,308	728	5,091	3,222	1,297	573
Kootenai	4,093	3,510	3,326	2,660	539	128
Lolo	1,025	1,874	1,172	904	268	-
Flathead IR	2,553	2,332	917	568	349	-
Fort Belknap IR	16	2	6	6	-	-
Rocky Boy's IR	127	36	78	65	13	-
Glacier NP	300	320	-	-	-	-
<b>Total</b>	<b>14,325</b>	<b>16,662</b>	<b>13,245</b>	<b>9,104</b>	<b>3,040</b>	<b>1,104</b>

\*Severity classes are defined as Low = 4-10%; Moderate = 11-29%; High >30%

**Table 5. Mountain Pine Beetle – caused Mortality on State and Private Lands, Statewide, 2015-2017 (Acres)**

Reporting Area	2014				2015				2016			
	LPP*	PP	HE5NP	WWP	LPP	PP	HE5NP	WWP	LPP	PP	HE5NP	WWP
Beaverhead*	3,448	4	188	0	64	0	26	0	15	1	3	0
Bitterroot	437	443	0	0	8	64	0	0	0	4	0	0
Custer*	0	0	0	0	0	0	2	1	9	2	9	0
Deerlodge*	663	12	300	0	22	4	6	0	0	0	0	0
Flathead	10	20	0	0	23	38	0	1	3	0	0	0
Gallatin*	20	1	36	0	13	0	6	0	0	0	0	0
Garnets	37	175	0	0	24	92	0	0	0	0	0	0
Helena*	10	126	0	0	7	49	0	8	4	14	0	0
Kootenai	420	12	0	145	18	10	0	0	14	6	0	0
Lewis and Clark*	13	171	4	0	18	113	23	0	0	0	0	0
Lolo	2,308	84	0	0	29	108	0	1	32	6	0	0
Blackfeet IR	0	0	0	0	2	0	0	0	0	0	0	0
Crow IR	0	0	0	0	2	0	0	0	0	0	0	0
Flathead IR	0	6	0	0	16	38	0	0	187	104	20	0
Fort Belknap IR	2	0	0	0	34	2	0	0	34	2	0	0
No. Cheyenne IR	0	0	0	0	0	0	0	0	0	0	0	0
Rocky Boy's IR	8	0	0	0	2	9	0	0	10	2	0	0
Glacier NP	0	0	0	0	1	0	0	0	0	0	0	0
Yellowstone NP	0	0	0	0	389	0	53	0	0	0	0	0
<b>Total</b>	<b>7,376</b>	<b>1,054</b>	<b>529</b>	<b>145</b>	<b>245</b>	<b>527</b>	<b>63</b>	<b>11</b>	<b>318</b>	<b>141</b>	<b>32</b>	<b>0</b>

\*Forests were combined for the survey this year as they are in management. For example, Beaverhead-Deerlodge is reported as a whole unit in 2017.  
LPP = Lodgepole Pine; PP = Ponderosa Pine; HE5NP = High Elevation Five Needle Pines; WWP = Western White Pine



**Table 6. Mountain Pine Beetle – Caused Mortality on all Federal Ownerships, Statewide, 2015-2017 (Acres)**

Reporting Area	2015				2016				2016			
	LPP	PP	HE5NP	WWP	LPP	PP	HE5NP	WWP	LPP	PP	HE5NP	WWP
Beaverhead*	70,355	26	8,895	0	2,287	0	738	4	1,062	59	280	2
Bitterroot	25,142	1,726	957	0	637	135	10	0	27	26	6	0
Custer*					0	0	72	4	149	0	350	0
Deerlodge*	17,688	6	2,756	0	299	0	83	2	0	0	0	0
Flathead	6,252	24	0	4	176	22	12	0	570	17	2	0
Gallatin*	764	5	642	0	340	0	66	0	0	0	0	0
Garnet	60	20	0	0	0	0	0	0	0	0	0	0
Helena*	77	33	22	0	55	8	2	1	553	54	76	0
Kootenai	1,151	18	2	4,752	1,349	152	0	4	1,519	410	10	0
Lewis and Clark*	171	98	294	0	217	52	64	2	0	0	0	0
Lolo	27,168	396	632	3	814	251	0	2	1,289	52	4	0
Blackfeet IR	4	0	0	0	16	0	0	0	0	0	0	0
Crow IR					9	0	18	0	0	0	0	0
Flathead IR	111	20	12	0	252	611	0	0	238	106	20	0
Fort Belknap IR	22	38	0	0	78	81	0	0	57	24	0	0
No. Cheyenne IR					0	0	0	0	0	0	0	0
Rocky Boy's IR	39	4	0	0	36	30	0	0	10	2	0	0
Glacier NP	2	0	0	0	301	0	0	0	0	0	0	0
Yellowstone NP	297	0	56	0	7	0	42	0	0	0	0	0
<b>Total</b>	<b>149,303</b>	<b>2,414</b>	<b>14,268</b>	<b>4,759</b>	<b>6,873</b>	<b>1,342</b>	<b>1,107</b>	<b>19</b>	<b>5,474</b>	<b>750</b>	<b>748</b>	<b>2</b>

\*Forests were combined for the survey this year as they are in management. For example, Beaverhead-Deerlodge is reported as a whole unit in 2017.  
LPP = Lodgepole Pine; PP = Ponderosa Pine; HE5NP = High Elevation Five Needle Pines; WWP = Western White Pine

**Table 7. Additional Bark Beetle – Caused Mortality on all Ownerships, Statewide, 2015-2017 (Acres)**

Reporting Area	Spruce Beetle			Fir Engraver			Pine Engraver			Subalpine Fir Mortality**			Western Pine Beetle		
	2015	2016	2017	2015	2016	2017	2015	2016	2017	2015	2016	2017	2015	2016	2017
Beaverhead*	436	181	31	0	0	0	0	0	2	132	820	1,050	0	0	0
Bitterroot	10	6	14	4	4	0	1,178	251	13	326	433	212	16	54	0
Custer*	0	0	-	0	0	0	0	1,088	0	00	142	1,264	0	0	0
Deerlodge*	0	4	-	0	0	-	0	0	-	36	225	-	0	0	-
Flathead	95	2	2	57	4,661	96	4	30	0	326	1,878	585	0	4	2
Gallatin*	161	3	-	0	0	-	4	4	-	232	579	-	0	0	-
Garnets	20	0	-	0	0	0	0	34	0	10	48	0	0	0	0
Helena*	0	0	60	0	0	0	12	12	52	52	583	1,019	2	0	0
Kootenai	43	4	10	10	4,007	2,250	0	10	10	112	3,224	1,293	0	4	34
Lewis and Clark*	56	0	-	6	0	-	32	145	-	506	431	-	0	0	-
Lolo	28	2	67	2	388	2,786	2	192	18	194	1,829	271	26	36	16
Blackfeet IR	14	16	0	0	0	0	0	0	0	12	92	0	0	0	0
Crow IR	0	2	0	0	0	0	0	104	0	0	4	0	0	0	0
Flathead IR	11	0	0	6	840	875	4	16	13	105	495	118	6	4	22
Fort Belknap IR	0	0	0	0	0	0	37	18	0	2	0	0	0	0	0
No. Cheyenne IR	0	0	0	0	0	0	0	218	0	0	0	0	0	0	0
Rocky Boy's IR	4	4	0	0	0	0	0	6	6	2	0	0	0	0	0
Glacier NP	171	151	0	0	106	0	0	0	0	18	1,452	0	0	0	0
Yellowstone NP <sup>1</sup>	86	12	0	0	0	0	0	0	0	157	20	0	0	0	0
<b>Total</b>	<b>1,135</b>	<b>387</b>	<b>184</b>	<b>83</b>	<b>10,002</b>	<b>5,132</b>	<b>1,273</b>	<b>2,124</b>	<b>114</b>	<b>2,222</b>	<b>12,366</b>	<b>5,812</b>	<b>50</b>	<b>96</b>	<b>74</b>

\*Forests were combined for the survey this year as they are in management. For example, Beaverhead-Deerlodge is reported as a whole unit in 2017

\*\*For the 2017 season this acreage is reported as Root Disease and Beetle Complex not Subalpine Fir Mortality.

**Table 8. Western Spruce Budworm Defoliation by Reporting Area on all Ownerships, Statewide, 2015-2017 (Acres)**

<i>Reporting Area</i>	<i>2015</i>	<i>2016</i>	<i>2017</i>
Beaverhead*	42,312	70,207	76,027
Bitterroot	34,739	17,567	38,549
Custer*	0	3,258	61,136
Deerlodge*	49,657	91,661	-
Flathead	165,264	59,414	3,300
Gallatin*	96,604	115,347	-
Garnets	4,460	0	0
Helena*	276,220	48,666	81,273
Kootenai	44,673	7,549	851
Lewis and Clark*	131,246	158,526	-
Lolo	279,311	64,878	24,498
Blackfeet IR	6,931	2,166	0
Crow IR	0	3,402	0
Flathead IR	39,183	7,407	3,493
Fort Belknap IR	62	0	0
No. Cheyenne IR	0	0	0
Rocky Boy's IR	161	0	0
Glacier NP	31,362	7,014	0
Yellowstone NP	2,830	6,423	0
<b>Total</b>	<b>1,205,015</b>	<b>663,485</b>	<b>289,127</b>

## COMMON AND SCIENTIFIC NAMES

Common Name	Pathogens	Primary Hosts
Annosus root disease (S-Type)	<i>Heterobasidion occidentale</i> Otrrosina & Garbelotto	DF, GF, SAF
(P-Type)	<i>Heterobasidion irregulare</i> Garbelotto & Otrrosina	PP
Armillaria root disease	<i>Armillaria ostoyae</i> (Romagn.) Herink	DF, GF, SAF, saplings of all conifers
Aspen heart rot	<i>Phellinus tremulae</i> (Bond.) Bond. & Borisov.	QA
Aspen shoot blight	<i>Venturia macularis</i> (Fr.) E. Muller & Arx	QA
Atropellis canker	<i>Atropellis piniphila</i> (Weir) Lohman & Cash	LPP
Black canker	<i>Ceratocystis fimbriata</i> Ellis & Halst.	QA
Black stain root disease	<i>Ophiostoma wagneri</i> (Goheen & F.W. Cobb ) Harrington	DF, PP
Comandra rust	<i>Cronartium comandrae</i> Pk.	LPP, PP
Diplodia shoot blight	<i>Diplodia pinea</i> (Desmaz.) J. Kickx fil.	PP
Dothistroma needle blight	<i>Mycosphaerella pini</i> Rost. In Munk	PP, LPP, LP
Dutch Elm Disease	<i>Ophiostoma ulmi</i> (Buisman) Nannf.	Elms
Dwarf mistletoes	<i>Arceuthobium</i> spp.	DF, LP, LPP, WL
Elytroderma needle disease	<i>Elytroderma deformans</i> (Weir) Darker	PP
Ganoderma	<i>Ganoderma applanatum</i> (Pers.) Pat.	QA
Indian paint fungus	<i>Echinodontium tinctorium</i> (Ell. & Ev.) Ell. & Ev.	GF, WH
Laminated root rot	<i>Phellinus weirii</i> (Murrill) R.L. Gilbertson.	DF, GF, SAF, WH
Larch needle blight	<i>Hypodermella laricis</i> Tub.	WL
Larch needle cast	<i>Meria laricis</i> Vuill.	WL
Marsonnina leaf spot	<i>Marsonnina populi</i> (Lib.) Magn.	QA
Red ray rot	<i>Dichomitus squalens</i> (P. Karst.) D.A. Reid	PP
Red ring rot	<i>Phellinus pini</i> (Thore :Fr.) A.Ames	DF, ES, PP, WL
Rhabdocline needle blight	<i>Rhabdocline pseudotsugae</i> Syd.	DF
Schweinitzii root and butt rot	<i>Phaeolus schweinitzii</i> (Fr. :Fr.) Pat.	Mainly DF, all conifers
Spruce broom rust	<i>Chrysomyxa arctostaphyli</i> Diet.	ES
Tomentosus root disease	<i>Onnia tomentosa</i> (Fr.) P. Karst.	ES, DF, LPP, SAF, WL
Western gall rust	<i>Endocronartium harknessii</i> (J.P. Moore) Y. Hiratsuka	PP, LPP
White pine blister rust	<i>Cronartium ribicola</i> J.C. Fisch.	LP, WBP, WWP
Balsam woolly adelgid	<i>Adelges piceae</i> (Ratzeburg)	GF, SAF
Douglas-fir beetle	<i>Dendroctonus pseudotsugae</i> (Hopkins)	DF
Douglas-fir tussock moth	<i>Orygia pseudotsugata</i> (McDunnough)	DF, ES, TF

## COMMON AND SCIENTIFIC NAMES

Common Name	Insects	Primary Hosts
Fall webworm	<i>Hyphantria cunea</i> (Drury)	CC
Fir engraver beetle	<i>Scolytis ventralis</i> (LeConte)	GF, SAF
Larch casebearer	<i>Coleophora laricella</i> (Hubner)	WL
Mountain pine beetle	<i>Dendroctonus ponderosae</i> (Hopkins)	All pines
Pine butterfly	<i>Neophasia menapia</i> (Felder & Felder)	PP
Pine engraver beetle	<i>Ips pini</i> (Say)	LPP, PP
Spruce beetle	<i>Dendroctonus rufipennis</i> (Swaine)	ES
Western balsam bark beetle	<i>Dryocoetes confuses</i> (Swaine)	SAF
Western pine beetle	<i>Dendroctonus brevicomis</i> (LeConte)	PP
Western spruce budworm	<i>Choristoneura freemanii</i> (Ratzeburg)	DF, GF, SAF, ES, WL

CC = chokecherry; DF = Douglas-fir; ES = Engelmann spruce; GF = grand fir; LP = limber pine; LPP = lodgepole pine; PP = ponderosa pine; QA = quaking aspen; SAF = subalpine fir; TF = true firs; WWP = western white pine; WH = western hemlock; WL = western larch; WBP = whitebark pine

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Figure 1. 2017 Reporting Areas for Montana

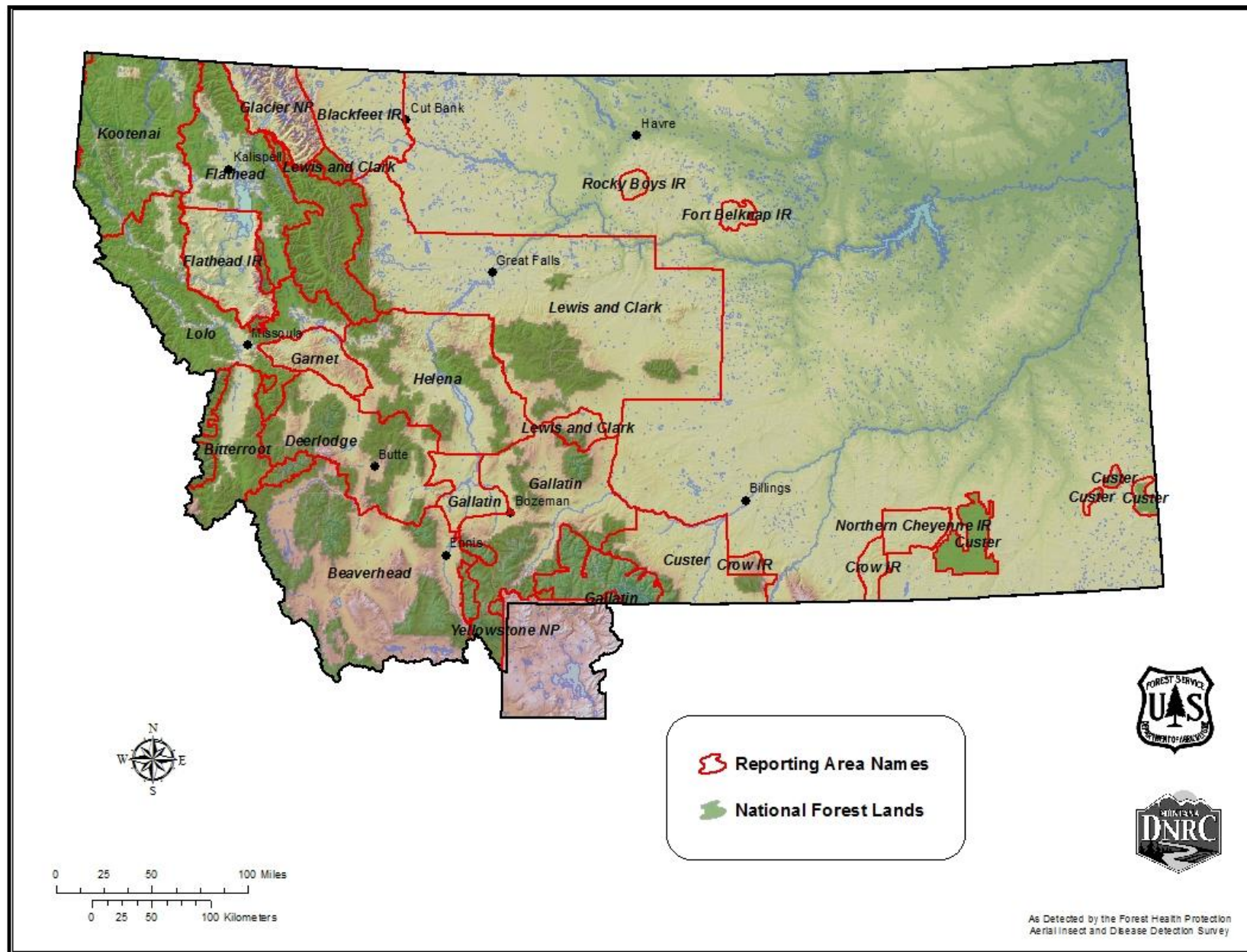




Figure 2. Areas Surveyed In 2017 Forest Health Protection Aerial Detection Survey in Montana

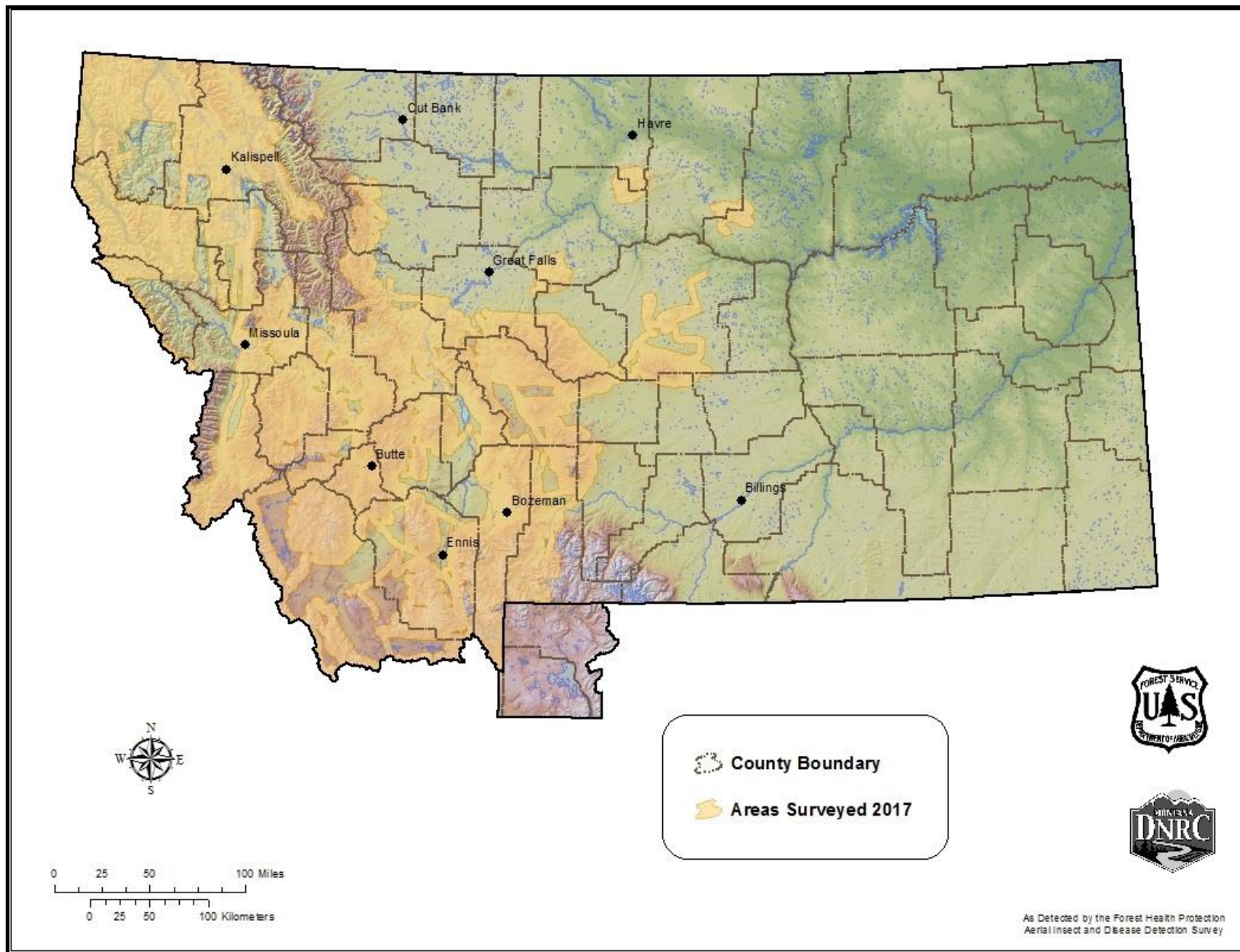


Figure 3. 2017 Douglas-fir Beetle Infestations in Montana

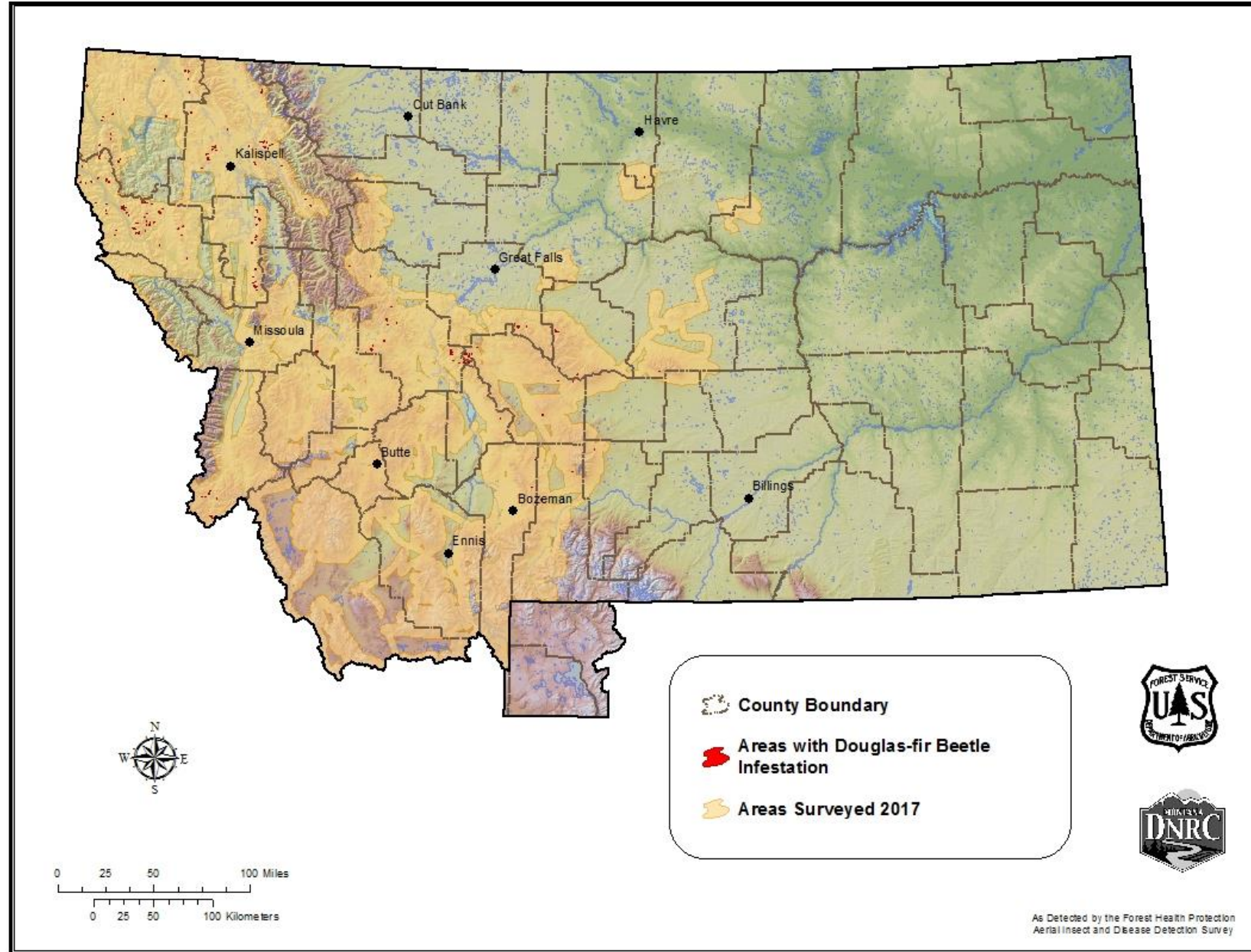




Figure 4. 2017 Fir Engraver Beetle Infestations in Montana

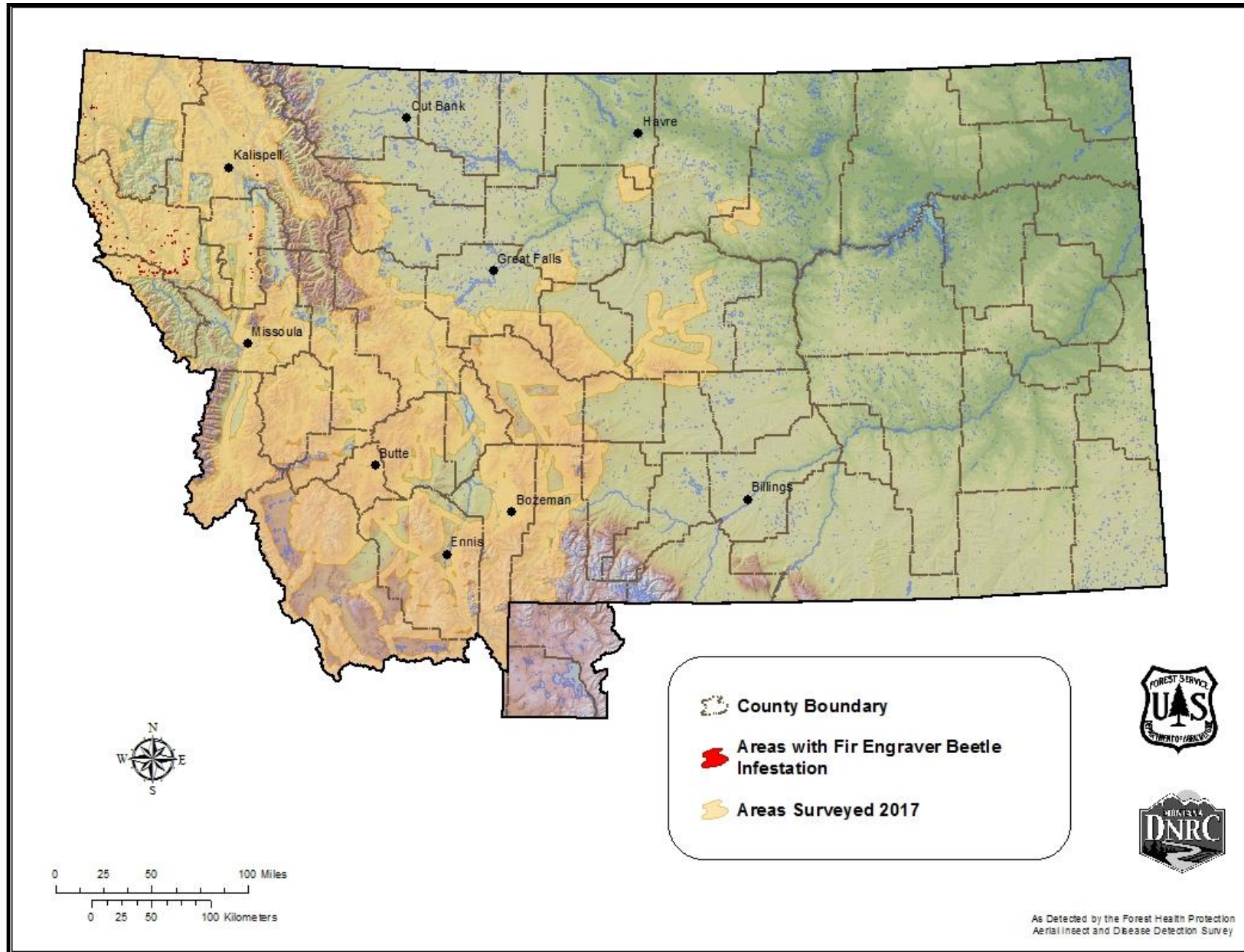


Figure 5. Mountain Pine Beetle – Caused Mortality in Montana 2017

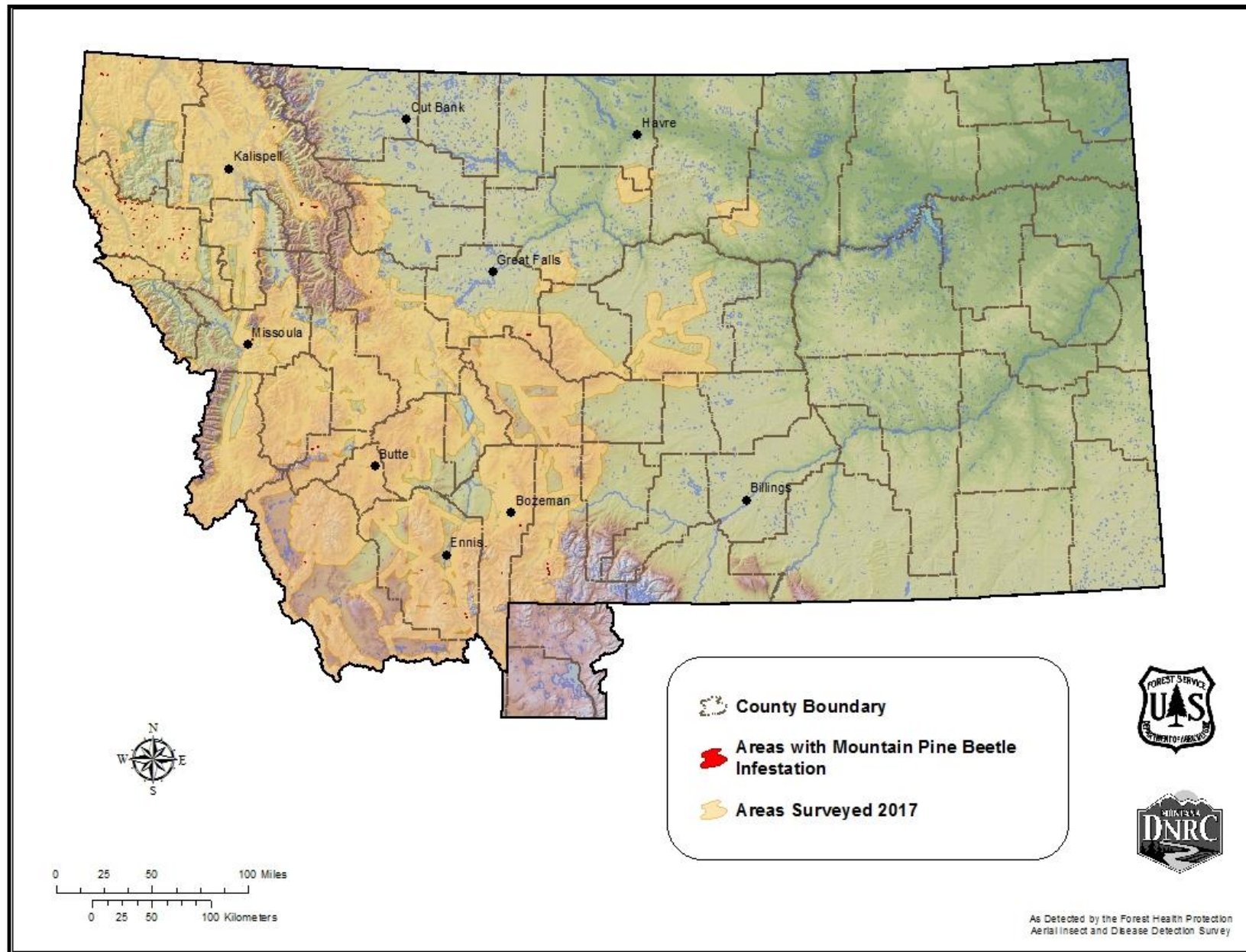




Figure 6. Root Disease/Beetle Complex Distribution in Montana 2017

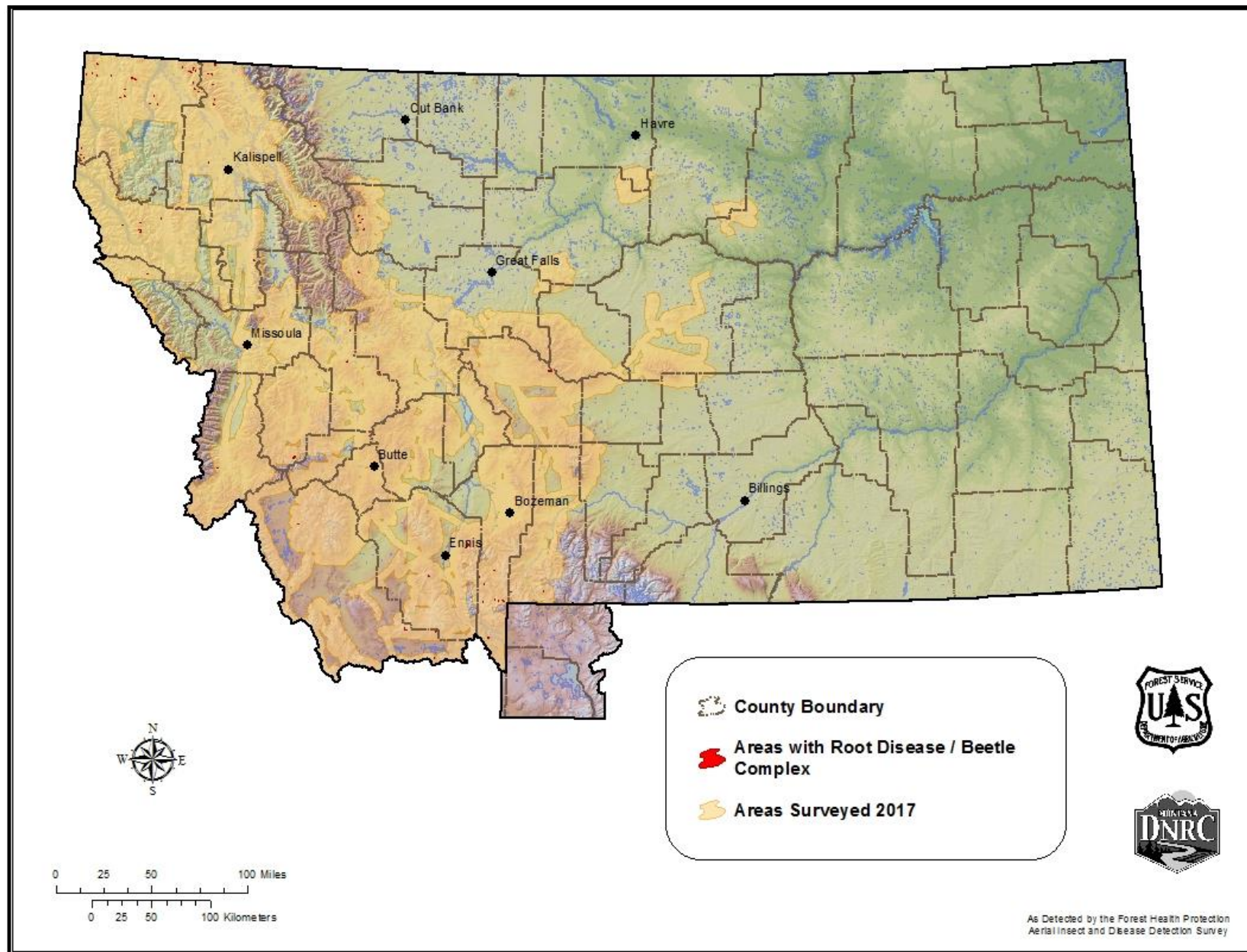


Figure 7. Western Spruce Budworm Defoliation in Montana 2017

